SCIENTIFIC AMERICAN

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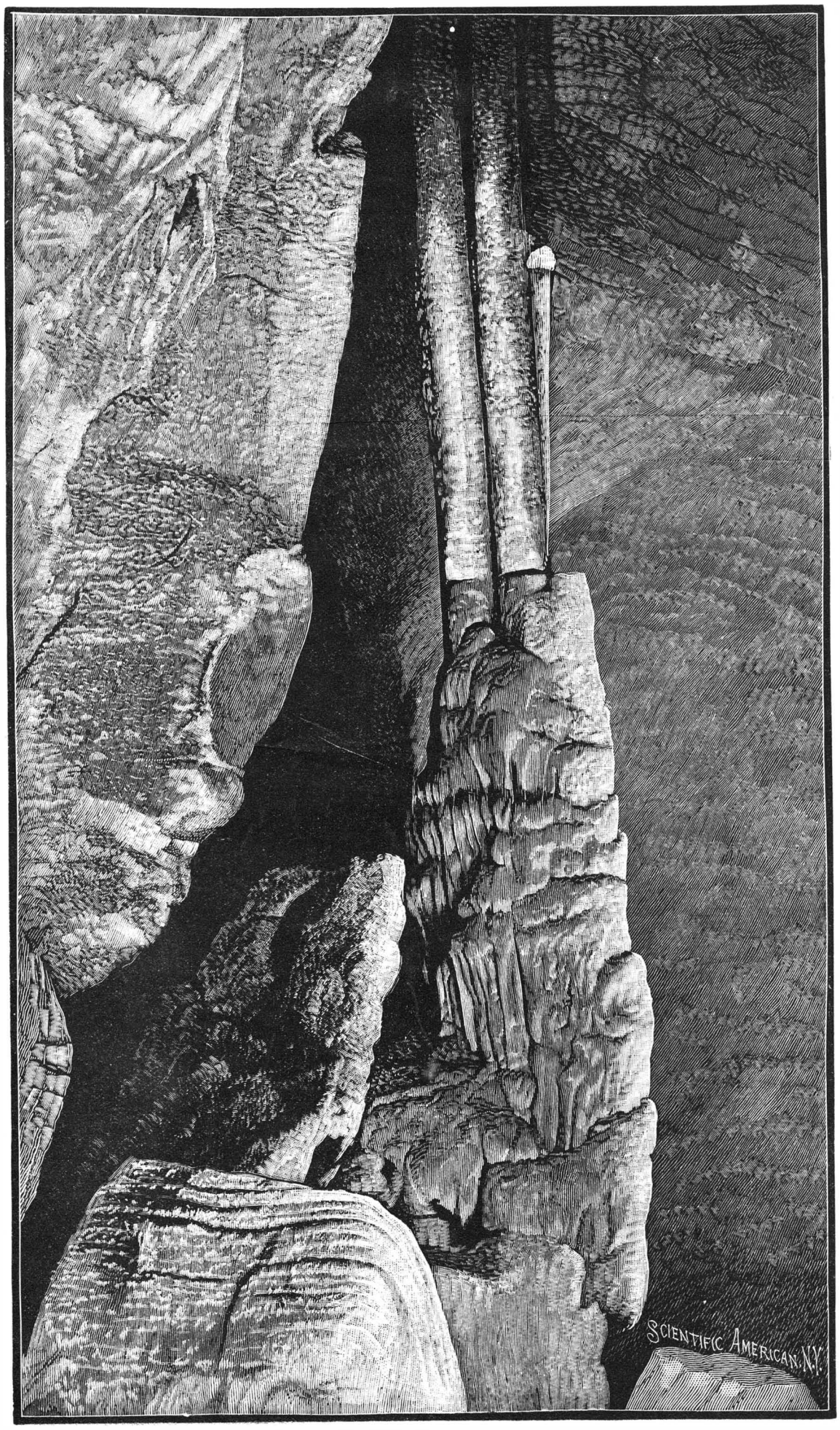
THE MARBLE CAVE OF MISSOURI.

BY E. O. HOVEY, PH.D.

A very large portion of the State of Missouri is honeycombed by caverns to such an extent that the underground drainage in many places deprives the surface of small streams. For many years, the existence of a large cave in the extreme southeastern portion of Stone County, Mo., has been known, but the inaccessibility of the locality has kept travelers, with but few exceptions, from attempting to visit it. Within the past year, however, such remarkable accounts of the wonders and extent of the cavern have appeared in the local and metropolitan newspapers that the Missouri World's Fair Commission and the State Geological Survey determined to investigate the cave thoroughly and see what there was of truth in the stories which had been so widely circulated. Consequently, our party of three, representing both organizations, besides our photographer, Mr. C. E. DeGroff, of Warrensburg, Mo., left Aurora, a live mining city of Lawrence County, about 270 miles southwest of St. Louis, on the "Frisco" road, one charming day last fall, to explore the new wonder of the world. The 40 mile drive over cultivated prairies and through fine open but almost uninhabited forests might be dilated upon, but the limits of our space compel us to hasten on to the description of the object of our journey.

Stone County lies for the most part on the southern slope of the so-called Ozark Mountains. These mountains, however, are merely hills and ridges which have been formed by the erosion of the plateau which is known to geologists as the "Ozark Uplift," and would

(*Continued on page 70.*)



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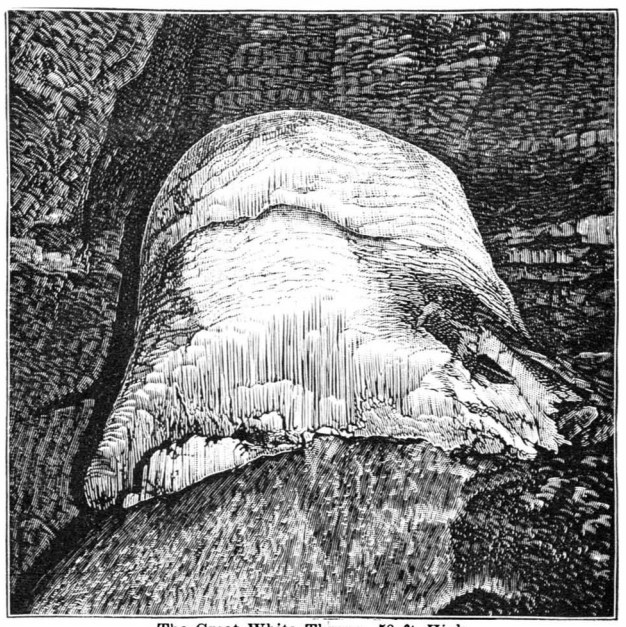
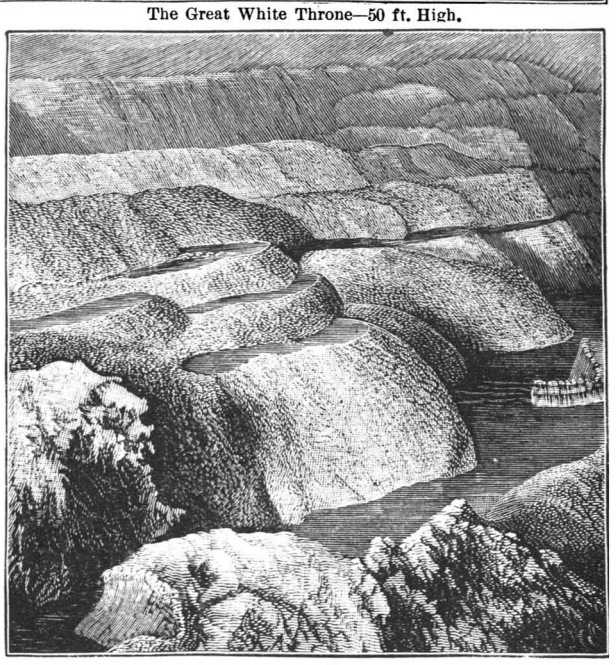
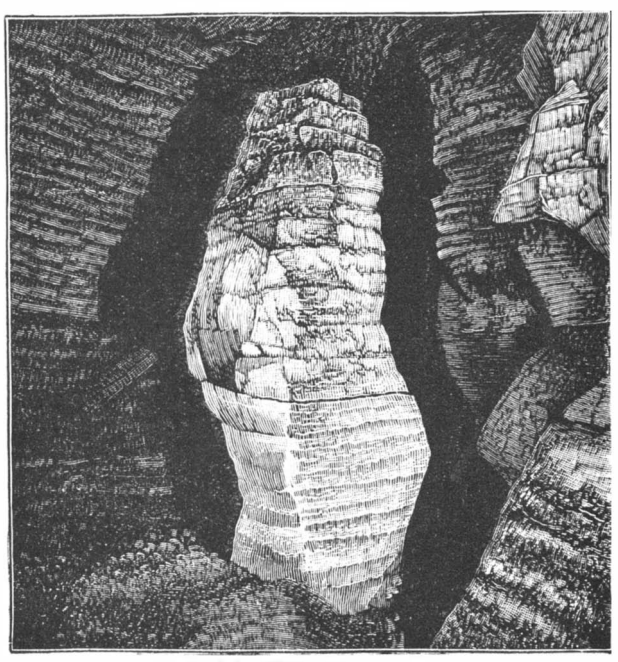


The Great White Throne—50 ft. High.



The Waterfall—20 ft. Across.



"She," in Mother Hubbard Room.

THE MARBLE CAVE OF MISSOURI.—ILLUSTRATIONS FROM PHOTOGRAPHS.

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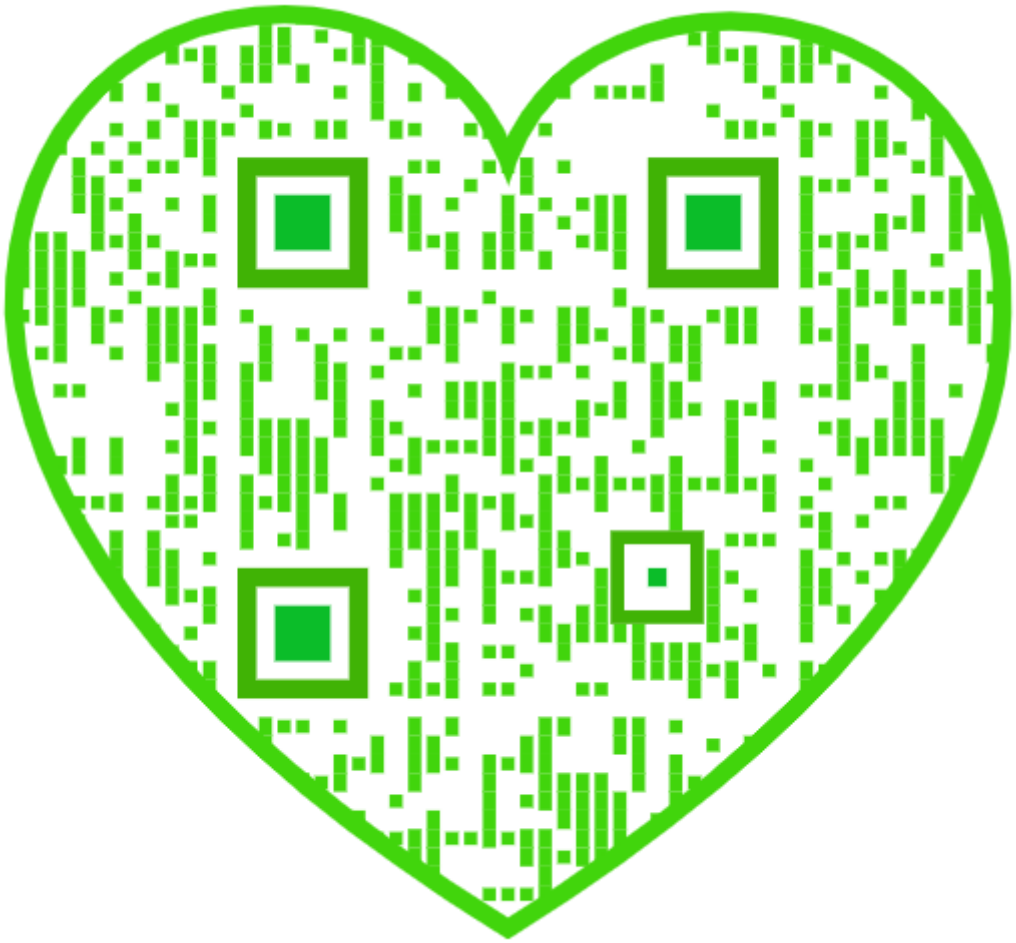

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ANOTHER BILL TO DISCOURAGE THE INVENTOR AND FAVOR THE INFRINGER.

A bill has lately been introduced in Congress by Mr. Tillman, of South Carolina, providing that no patent shall, by reason of a broad or dominating claim or otherwise, prevent the practice or use of any patented actual improvement in the invention forming its subject matter, provided the patentee or owner of the improvement shall pay a reasonable royalty or tribute to the owner of the patent having the dominating claim, the amount of royalty or tribute to be determined by a court of the United States, the court to take into consideration the profits, past or prospective, to the owner of the improvement and the damages of the dominating patent, similar as in the case of a decree for infringement.

The law as it stands awards to the original and first inventor the exclusive right to make use and sell his invention for the short period of seventeen years.

The proposed law takes this right away from the inventor and bestows it upon the court, thus making the court in the first instance a party to the control and management of the patent. Under this proposed law not only is the inventor deprived of his exclusive rights, but the infringer is allowed to drag the original inventor into court, subject him to trouble and expense, requires the court to discriminate in favor of the infringer, and compels the inventor to share the proceeds of his invention with the infringer.

Of all the schemes to emasculate the patent laws, the foregoing plan of giving encouragement and support to infringers by legal enactment is the worst and most absurd. It remains to be seen whether Congress will sanction such an act of folly. It is in direct contravention of the spirit and intent of the constitution of the United States, which provides in Article 1, Section 8, that Congress shall have power to promote the progress of science and the useful arts, by securing, for limited times, to authors and inventors, the exclusive right to their respective writings and discoveries.

THE EXCLUSION OF CHINESE.

On January 18 of the present year, at Duluth, Minn., Judge R. R. Nelson, of the United States Court, rendered a decision in the case of a Chinaman who was brought before him on *habeas corpus* proceedings in a suit under the Chinese Exclusion Act. The case was a motion for the release of Ah Yuk, a Chinaman, who had violated the act. The accused was a seven-year resident of the United States. Under the act he was to have been returned to China. His crime was illegal presence in this country. The motion for his release was based on the theory that the imprisonment for thirty days and the returning to China of such persons as the accused, after no other proceedings than a hearing before a United States Court Commissioner, was unconstitutional. The right to a trial by jury was pleaded, and the judge acquiesced in the counsel's plea. The act, in the provision affecting the prisoner's case, was held to be unconstitutional, and the prisoner was released.

The Chinese Exclusion Act has recently been attracting much attention and criticism on account of the radical measures embodied in it. It forms Chapter 60 of the laws passed by the 52d Congress, and is dated May, 1892. It begins by holding in force the previous laws excluding Chinese. It then ordains that Chinese not legally here shall be removed to China or to such other country as may claim them. If they do belong to another country, and if a fee or immigration tax is required on their return to such country, they shall be sent to China. If adjudged guilty of illegal residence the culprit, as this law treats him, is liable to a year's imprisonment before removal. No bail is allowed on *habeas corpus* proceedings. All Chinese laborers entitled to remain here are, within one year from the passage of the act, to apply for a certificate of residence, or otherwise are to be arrested and proceeded against.

These are the main provisions of this act, one which makes the breathing of the air of the United States a crime if perpetrated by a Chinese. The exclusion or restriction of a tide of immigration from the Orient, with its hundreds of millions of aliens, may be necessary. The immense Chinese empire could pour out upon our shores an entire population of their race without feeling the difference. The good qualities of the Chinese are undoubted, but they do not assimilate with the Caucasian race. They do not come here to found homes for their children. Their stay here is merely an exile submitted to as a business venture. They bring with them nothing that can be of profit to us. They leave behind them nothing except work executed by them as laborers.

Our nation of sixty millions of people is threatened by another problem in the race question. Already the existence among us of some eight millions of negroes is regarded by political economists as the basis of a very difficult problem, which is far from solution. The elements of this case are similar to those of the Chinese immigration question. In both cases there are unassimilatable races of small capitalization. But with the Chinese there is present the additional difficulty that they simply desire to send in floods of temporary residents, with almost limitless sources of supply of new immigrants to crowd out our own people from many avenues of trade and labor.

If a permanent population of eight millions of negroes, not re-enforced by immigration, is enough to constitute a difficulty for political economists to dispose of, what may we not be confronted with in a floating population of indefinite capability of extension. It certainly seems that we are entitled to adopt some measures of restriction. But the humanitarian aspect of the case tells against the present law.

A year's imprisonment is the measure of the criminality of simple residence. This is certainly a measure unworthy of a civilized people. It fairly savors of ferocity to imprison for so long a period one whose offense is mere existence. The decision that the act is unconstitutional in one particular serves to emphasize its broad injustice. By no principle of justice can the presence of an inoffensive person in a country be construed as a crime. The expulsion of the Jews from Russia is really the only instance of the present day that is comparable with the action of the United States as dictated by the Chinese expulsion laws.

The limitation of the numbers coming here could be otherwise brought about. A poll tax could be levied on every Chinese entering the country. This could be made high enough to deter them from coming in large numbers.

Already many murmurs of dissatisfaction are making themselves heard. It is felt that the Chinese government may yet adopt retaliatory measures which will make themselves felt upon American residents of China. Independent of the fear of such action the injustice and inhumanity of the act should suggest its amendment. Laws proposed as substitutes of increased severity should be discouraged. Excessive immigration would be amenable to more logical and juster methods of treatment.

Gobelins Tapestry.

A report of the United States consul general in Paris on French tapestries gives some interesting information in regard to the famous Gobelins factory. It was founded in 1607 by Henri IV., in the scarlet dye works originally established in the fifteenth century by Jehan Gobelins. In 1662 it was bought by Louis XIV., on the advice of Colbert, and formed into the "Manufacture des Meubles de la Couronne," with 800 workmen directed by the most celebrated artists. After the death of Louis XIV., the factory reverted to its original work of making tapestry only. The national factory of Gobelins is now divided into three sections, dye shops, tapestry shops and carpet workshops. The first not only produce every color, but twenty or thirty shades of each. The execution of the tapestry is so slow that an artist cannot produce more than a fourth of a square yard in a year. In 1826 the manufacture of carpets was added. These are remarkable for their softness and the evenness of their tissue. Some of them take five to ten years to produce, and cost from 60,000 francs to 150,000 francs. Several tapestries of special importance exhibited at the Gobelins are mentioned by the consul general. A portrait of Louis XIV. by Rigaud is considered the *chef-d'œuvre*.

A special account of the method of making the tapestry, by Mr. Debray, an expert, is also given in the report. This gentleman says that the value of Gobelins is on the average 3,000 francs to 4,000 francs per square meter, while that of the Beauvais tapestry is as much as 7,000 francs. The characteristics of Gobelins are large historical scenes and reproductions from celebrated paintings. Sales to private persons are only permitted by the special authority of the minister of fine arts. To the Gobelins factory is joined the carpet factory of La Savonnerie (the building in which this work was first commenced was originally a soap factory), in which velvet carpets, reproducing historical and mythological subjects, are manufactured in the same way as velvets. The artists at Gobelins receive very high salaries. Hand looms only are employed, and tapestries of the ordinary dimensions require on the average three years. The manufacture of silk tapestries at Nimes has been declining since 1750, and there, as at Aubusson, it is in private hands. At Beauvais as well as Gobelins the manufacture is controlled by the state. Cotton warps, called *boyaux*, are employed, the weft is of twofold wool, and is a species of Australian mohair wool, denominated *laine brodé*, its characteristic being that it is open and firm. The wefts are dyed by expert chemists and dyers, by the old method of wood dyes, such as indigo, cochineal and curcuma. Part wool and part silk tapestries are also manufactured, and a limited number all silk.

A Luminous Fungus.

The *Union Medicale* for December 27, 1892, gives a short account, from the *Revue Scientifique*, of the *Pleurotus lux*, a fungus that takes its specific name from its property of glowing in the dark, even for twenty-four hours after it has been plucked. It has lately been carried to Europe from Tahiti, where the women use it as an adornment in bouquets of flowers.

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The World's Columbian Exposition.

THE PRESENT CONDITION AND PROSPECTS OF THE GREAT ENTERPRISE—INTERESTING NOTES AND PARTICULARS.

CHICAGO, February 1, 1893.

It has been officially announced from the time of the organization of the World's Columbian Exposition that the formal opening to the public would be on May 1. This date is now three months off, and such an immense amount of work remains to be done that the question arises as to the ability of the Exposition management possibly to come up to time in accomplishing this work. Cold weather has practically prevented outdoor work for some weeks past, and but little work is carried on on the exterior of the buildings. Much important work is still to be done in completing the layout of the grounds. Walks and drives are to be made and hardened, much turfing to be done, flower beds laid out, and other such work done that requires time.

More important than these, however, is the question of installing exhibits. The amount of space to be devoted to exhibition purposes is a little over 3,500,000 square feet. Nearly 1,500,000 square feet of this has been assigned to foreign countries. The Manufactures and Liberal Arts Building, the Palace of Mechanic Arts, the Transportation Building, the Mining Building and others still have some space to spare. Many applications for space in these buildings are on hand and have not yet had assignments made, so that space is by no means begging. In the Electricity Building more than twice the available space has been applied for. Last week a little gain was made, as the allotments made to Mexico, Australia, Canada, Italy and several other nations had not been accepted; so, by the expiration of the time in which acceptances were to be made, the space has reverted to the use of the department to distribute to other exhibitors.

Of the 3,500,000 feet of space to be devoted to exhibition purposes, not a single exhibit is in place in the more important buildings, and with but two exceptions the buildings themselves are not completed. The status of these buildings is as follows:

Manufacturers and Liberal Arts or Main Building.—So far as the exterior is concerned work is completed, but in the interior a large area is yet unpainted. Three railway tracks extend the whole length of the building from south to north for the purpose of unloading exhibits, and quite a number of boxes of exhibits are scattered about. The floor plan is all marked out, but work has not been begun on installing an exhibit. With nearly 800,000 feet of space to be covered with exhibits, three months seems a remarkably short time in which to accomplish all the necessary work.

Palace of Mechanic Arts, or Machinery Hall.—Prospects are rather less encouraging for the prompt completion of the exhibit in this building than in any other. Several weeks' work remain to be done to finish the exterior of the building. Work on the interior is greatly behind, and much remains to be done before it can be painted. Huge pieces of machinery are scattered about—part of a dynamo here, a fly wheel there, and parts of engines hither and yon. The foundations for the heavy installations are all completed, and most of the flooring is laid. The three electric traveling cranes are in place, and are quite invaluable in expediting things, especially in placing the engines and other heavy machines on their foundations. Three railway tracks enter the building at the west end, and as exhibits are unloaded they are speedily removed by use of the cranes. Half a dozen of the fifty or more engines of the great power plant are in place; but these are by no means ready to put into operation. A few of the boilers are ready for use; in fact, some of them have already been fired up, but most of the batteries are not completed, and work has not been begun on some of the installations, not a brick being laid, or even the preliminary work of clearing away the ground begun. A temporary electric plant occupies space where part of the engine plant is to be, and temporary circuits are stretched from this plant through the building. Among the eminent names in the mechanical world that are conspicuously lettered on the exterior of this building is that of Seimens. It would be an unfortunate blunder not to have this spelling corrected before the Fair opens.

Agricultural Building.—Work is completed on this building, both exterior and interior, and considerable work has already been done preparatory to installing the exhibits of Illinois, Wisconsin, and New Jersey.

Electricity Building.—This building is completed so far as work on it is concerned, and the Bell Telephone Company and the Western Electric Company have the structures to accommodate their exhibits well toward completion. The former occupies a commanding position directly in front of the main entrance at the south end of the building, and gives promise of being very complete. It occupies a space 100 feet long by 75 feet wide, and is raised four feet above the floor of the building, broad stairways leading up to it at each end. A railway track has been laid the entire length of this building on the east and also on the west side, so that with two large temporary electric elevators, just completed, exhibits should be speedily handled and installed.

The Mining Building was completed, so far as the structure was concerned, months ago; but the interior is yet to be painted and the first step toward installing exhibits is not as yet taken. A railway track has been laid through the center of the building preliminary to this.

The Transportation Building is completed; but the work of painting the interior is not quite finished. Tracks for the exhibition cars are all laid, and the electric transfer table is already in operation.

Previous to the dedicatory exercises, last autumn, 8,000 men were employed inside the Fair Grounds. With such a force buildings sprang up almost in a day and slabs of staff were put in place with marvelous rapidity. Need for more such rapid work is now at hand, and it is to be hoped work may be pushed with the vigor that it was then. The facilities are at hand, so far as the Exposition is concerned, for completing its part of the work in time if the vigorous effort of last autumn is again resorted to; and if exhibitors are prompt in doing their share the Exposition may open May 1 in a satisfactory state of completion. But with all the delays incident to having so many interests work promptly and in harmony, the prospects are not as satisfactory to the friends of the Exposition as it is wished they were.

Invitations have just been received in Chicago from the Westinghouse Electric and Manufacturing Company, asking an inspection of some of the electrical apparatus which is to form part of the incandescent lighting plant at the Fair, and which is now exhibited at this company's shops, previous to its being shipped to Chicago. The feature of particular interest at this display is one of the 10,000 light dynamos direct coupled to a 1,000 horse power Westinghouse compound engine. The maximum capacity of each of these dynamos is placed at 15,000 sixteen candle power lamps. The weight of each dynamo is 150,000 pounds. The armature alone weighs about 42,000 pounds. The minimum number of lamps called for by the contract between the Exposition and the Westinghouse Company is 92,000 of sixteen candle power, but the company officially announces in its circular that the plant to be installed will be prepared to run 130,000 lamps. The display in Pittsburg also includes the first public test of the new stopper incandescent lamps, which are to be used in the Fair installation. It is believed that the daily renewals of lamps when the exposition is well under way will be about 1,000 lamps. In order to make a practical exhibit of incandescent lamp making, the company proposes to have as part of its display sufficient facilities to make all their renewals by renewing the carbon burners of the burned-out lamps. As the current from the large generators will be multiphase, the new Tesla motors will be operated by it in addition to the lighting in the Electricity Building. Another prominent feature of this company's exhibit is announced to be the latest development in long distance transmission of electricity.

So much has been published in the daily press regarding extortionate prices that are to be charged for board and lodging during the holding of the Fair that the Exposition management has taken official action on the subject. Major Kasson, of the Bureau of Public Comfort, has had a canvass made of the city and has established an official directory of desirable rooms and suites of rooms. The bureau offers to sell rental certificates against these rooms, guaranteeing a reasonable and specified price, ranging from $1 upward. In this way intending visitors can select in advance rooms to suit their purses and their convenience, as the directory includes rooms from Lincoln Park on the north to Seventy-third Street on the south. Inside the Fair Grounds ample facilities have been provided for feeding the crowds, as 150,000 or more square feet of space have been reserved for restaurant purposes. It is intended to have these accommodations sufficient to provide for 75,000 people, and on special days nearly as many more. Restaurants will be provided in each of the large buildings and in all parts of the grounds.

Some months ago what were supposed to be ample plans were made for a hospital service at the grounds during the holding of the Fair. The Board of Lady Managers have become interested in the perfecting of these arrangements, particularly as it offered opportunity to show one of the most successful lines of woman's work, and as a result of this interest the hospital service will not only be planned with a view to caring for the ill and the injured, but it will also be made an exhibit. Leading hospitals in the country will join in the effort to carry out this plan. Several of the best trained nurses in Chicago have offered their services to the Exposition management in order that the hopes of what this hospital ought to be may be realized. All the latest devices for hospital use will be shown in actual operation and use in this hospital, while the ambulance service will be made as complete as possible.

The temporary electric circuits that have been used for supplying current to the various parts of the grounds have been unsightly, as the poles seem to have been set with regard to their being most conspicuous. Now that the subways are all completed and the permanent circuits installed, these poles and the temporary circuits are being removed. Until within a few weeks it has been proposed to string some of the permanent circuits under the elevated tracks of the intramural road, but it has finally been decided that these with all other wires shall go underground.

Dr. Hornsby, who has been secretary of the Department of Electricity since its inception, has been promoted to the position of assistant chief, with increased salary. This is a deserved promotion, as Dr. Hornsby has done practically all the work of the department from the first, the duties of Professor J. P. Barrett, chief of the department, as city electrician of Chicago, having prevented him from giving much direct attention to World's Fair matters.

The American Institute of Electrical Engineers has been assigned a suite of rooms in the gallery at the south end of the Electricity Building, adjoining the offices of the Department of Electricity. With such facilities, the Institute will be able to fittingly accommodate its members and entertain the many eminent electricians who will be in attendance at the Exposition.

Mr. Willis Hawley, of Urbana, Ohio, has been appointed consulting engineer to the Department of Electricity, and has already entered upon his duties. He is to aid Assistant Chief Hornsby, of this department, in taking immediate charge of the work of installing exhibits.

Activity of Three North American Volcanoes.

Padernal Peak, situated in the wilds of Rio Arriba County, New Mexico, is reported as now in a violent state of eruption, and is belching forth sulphurous fumes and lava at intervals of about three hours, each lasting about thirty minutes.

This has been going on since the last week in December. The entire top of the mountain, which was almost square and about a mile in extent, is stated to be blown off, and the lava pouring down the sides has already filled up the valley for about half a mile on each side.

A considerable portion of a ruined city of the ancient cliff dwellers will be covered with the slag should the eruptions continue. Padernal Peak is one of the most prominent landmarks of the Territory. The Mexicans say that it burst forth in violent eruption in 1820 and did not cease for nearly a year afterward. It has lain dormant until the present time.

The rumbling noise and lurid light can be plainly heard and seen at Sierra Amarilla, seventy miles distant, and an army of people from there are now at Ariquin to witness the impressive sight.

An earthquake shock felt at Orizaba, Mexico, recently, greatly frightened the people living in the vicinity of the Orizaba volcano.

The town of Orizaba lies about seventy miles by rail southwest of Vera Cruz and about twenty-five miles south of Mount Orizaba, the snow-clad peak of which is said by some to be 17,380 feet above sea level, and by others to be the highest peak in North America.

The residents of Colima, the capital of the Mexican State of that name on the Pacific coast, also feel a nervous apprehension regarding the volcano of Colima, which, reaching a height of about 12,000 feet, looms skyward about thirty miles northeast of the capital. Every night a lurid light illuminates the sky above the mountain, and it is feared that this portends a serious eruption.

Vegetable Growth in Water Mains.

A vegetable growth in the water mains at St. Paul, Minn., has lately, according to the *Engineering Record*, been the cause of some trouble. The first case was discovered by the superintendent, in one of two service pipes in a single trench supplying a double house. A complaint was made of bad water, which flushing failed to improve. One of the pipes delivered pure water and one supplied a muddy liquid that was of no use. This fact led to the conclusion that one of the services was foul; and the remedy applied on this supposition proved effective. The boiler of a portable engine was connected with the faucet of the kitchen sink from which the muddy water came, and a steam pressure of 70 pounds forced against the 35 pounds water pressure for 30 minutes—thereby driving the water out of the pipe. Since that time the pipe has always delivered clear water, and twelve similar cases have been successfully treated in the same manner. Great care has to be taken that there are no leaks in the service pipes, and that none of the fittings are open during the steaming process.

How to Freeze Water on a Small Scale.

Take a concave watch glass, touch the convex side upon water so as to leave a drop hanging on the glass. Pour a little ether into the concave and blow upon it. The rapid evaporation of the ether will render the glass so cold that the drop of water will be frozen.

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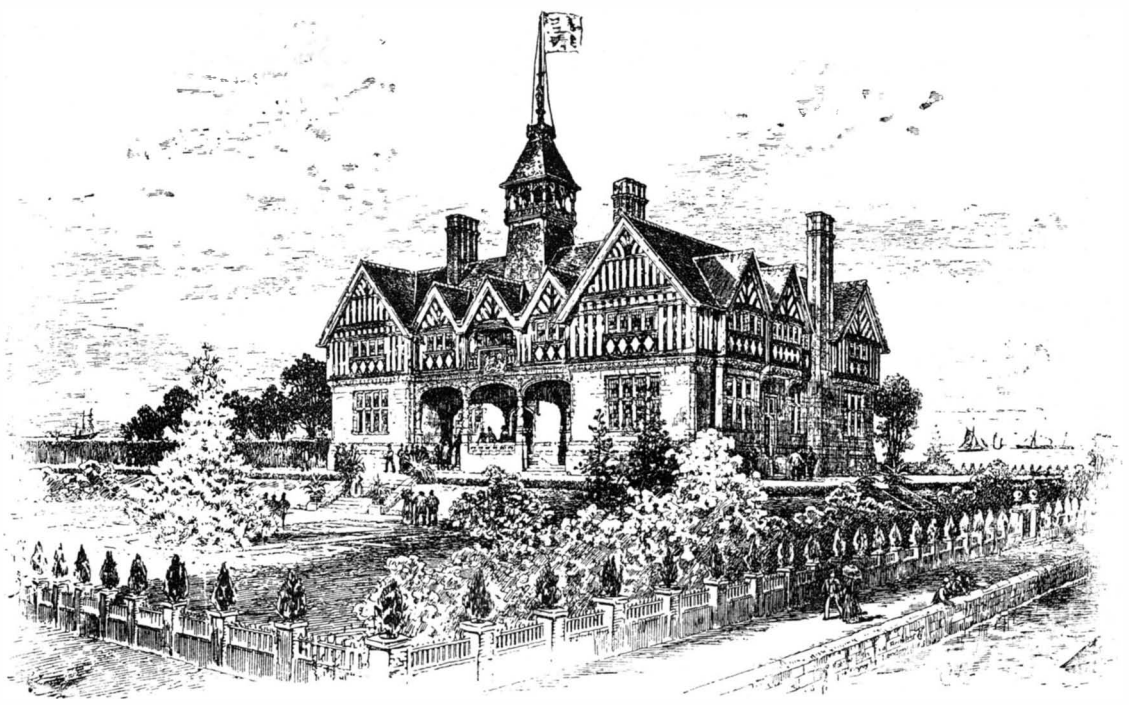
THE WORLD'S COLUMBIAN EXPOSITION.

THE BRITISH SECTION.

"Westward the course of empire takes its way," as Bishop Berkeley sang a century ago. Never was it truer than to-day, when all our thoughts are turning Chicagoward. So a representative of the *Illustrated London News* sought an opportunity of gaining from Sir Henry Trueman Wood a few particulars as to the progress of the British Section in the World's Fair, which opens next May.

Sir Henry Trueman Wood, in his business-like office in the Adelphi, has for some time past been "doubling the part," as actors say, of secretary of the Society of Arts and secretary of the commission which is dealing with the various questions in connection with Great Britain and the Chicago Exhibition. His experience of exhibitions has resembled Sam Weller's acquaintance with London in being "extensive and peculiar." He first found scope for his energy and great powers of organization in connection with the Health and the Inventions exhibitions, held respectively in 1884 and 1885. The difficulties attending the Paris Exhibition of 1889, which had been refused official recognition from the British government, only served to call forth the skill of the secretary of the Society of Arts in surmounting them. His services on this occasion were gracefully acknowledged by his creation as an officer of the French Legion of Honor and by knighthood conferred by his sovereign.



THE VICTORIA BUILDING—OFFICES OF THE BRITISH SECTION OF THE CHICAGO EXHIBITION.

"Well, first of all, how much ground will the British section cover?" was the opening for conversation.

"About 500,000 square feet, I expect. Of this space, two-fifths will be occupied by our colonies. This is a decided advance on previous exhibitions, for our maximum has been hitherto 360,000 square feet—at the Paris Exhibition of 1878. By the way, I may tell you that to view every exhibit in the World's Fair one will require to walk fifty miles."

"Then as to the total of British exhibitors?"

"Well, I fancy we shall be represented by six hundred in the industrial sections. In the Fine Art Section there will probably be between eight hundred and nine hundred works, by some three hundred artists. About one thousand applications were received, and every care has been taken to select those exhibits which shall give an adequate and interesting picture of Great Britain's commerce and art. Allotments were made to us in the following departments: Agriculture, Electricity, Fine Arts, Fisheries, Forestry, Live Stock, Machinery, Manufactures and Liberal Arts, Mines and Mining, Transportation, and in the Women's Building."

"Will there be much moving machinery?"

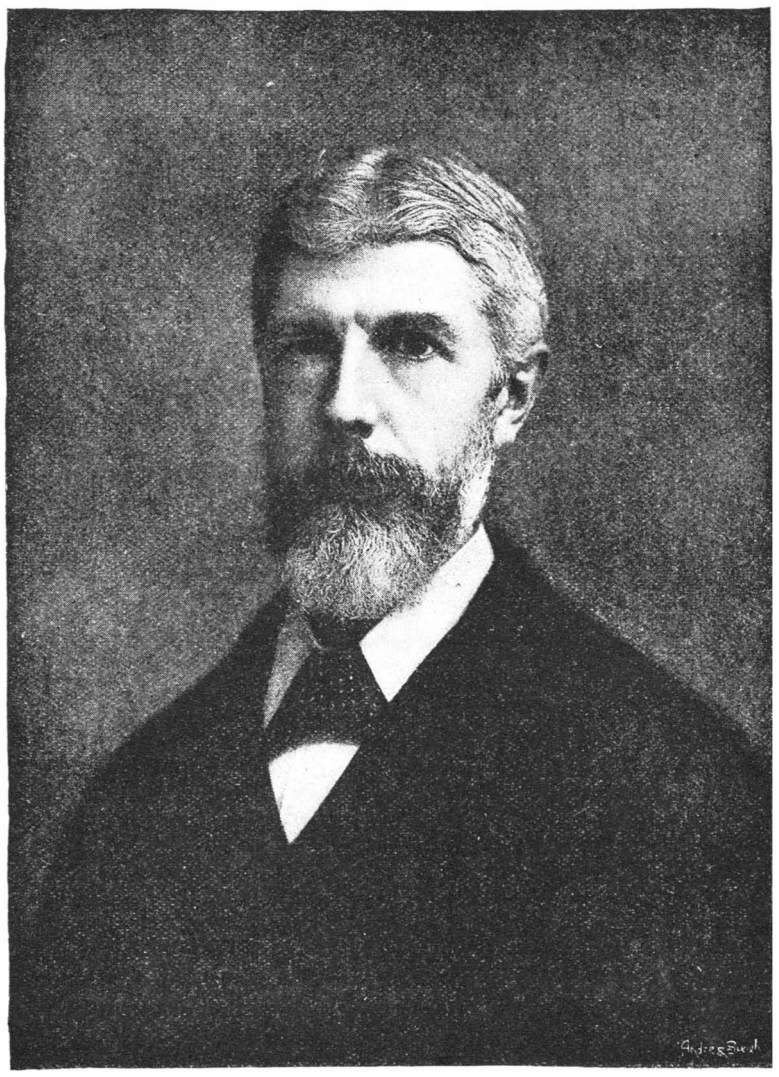
"Three steam engines will be at work, but I think one of the finest exhibits in this department will be Platt's cotton-cleaning machinery. Printing and typesetting will be illustrated, and there will also be shown looms, spinning frames, steam hammers, and the usual miscellaneous machinery."

"Where will the chief British exhibits be on view?"

"In the Manufactures Building, where will be found some fine specimens of such heterogeneous goods as Worcester porcelain, Doulton ware, jewelry, furniture, silks, wall papers, billiard tables, linen and old gold work from Ireland, chemical products, etc., and in the gallery of this section there will be a great attraction in the shape of photographs—oh! yes; the ubiquitous amateur photographer will be represented—newspapers, scientific instruments, and various educational appliances used by the School Board for London and the Science and Art Department."

"How have your appeals for pictures been answered?"

"I attach a good deal of importance to the Fine Art Department. The Americans nowadays are greatly given to French art, and they really appreciate but very little the British school of art, so that this ought to prove an excellent opportunity for finding a market. The New York dealers, who have the whole control of the market, do not encourage the sale of English pictures, and it is quite a limited number of important canvases by our leading artists which finds its way across the herring pond. Nearly all the Royal Academicians will be represented. Now as to your query about the replies we have received on this subject, I have found in the north of England that the McKinley tariff has left such a sore feeling with many private collectors that they have been very loth to assist the World's Fair in any way."



SIR H. TRUEMAN WOOD.

"As to public galleries; do you get any pictures loaned?"

"No; scarcely any. Now in France or Germany, with just the assent of the government, which is never difficult to obtain on this point, an exhibition may borrow largely from public collections. But the National Gallery and the South Kensington pictures are precluded from being lent. The Queen has graciously set the example to private collectors by lending us certain pictures." "Will you tell me what are going to be the British contents of the Transportation Gallery?"

"In the first place, there will be engines and carriages from various railway companies. Then there will be cycles, a model of the Forth Bridge, pictures and carriages (and for good vehicles Americans usually come to England), and ship models from most of the great firms. This latter exhibit is certain to be popular, judging from the success which the Naval Exhibition attained."

"As to the part which our colonies are going to play, will you give me some details?"

"Canada will hold premier position, showing extensively in the Agricultural, Mining, and Manufactures Buildings. Next to the Dominion comes New South Wales, sending merchandise and timber. They are going to have an enormous trophy representing the silver taken out of the Broken Hill mine. Ceylon will have a great deal of tea, naturally both for show and for sale. Both Ceylon and India intend to have native attendants on the spot to give a local coloring to their tea stalls. You may recollect that India was very late in deciding as to whether it would be represented at the exhibition, and as a result of the government's delay and refusal to take an active part in the matter India was not able to obtain as much space as might have otherwise been the case. However, I think we shall have no reason to be ashamed of her exhibits. Of course, specimens of Indian art, which meet you everywhere, will not be lacking. Finally, the Cape is determined to manifest its importance by showing the various processes connected with diamonds such as the washing and searching in the blue clay for these precious stones. Curiously enough at these exhibitions there is always a profusion of diamonds in every sample of clay!"

"Is Great Britain contributing much to the Electrical Section?"

"Not so much as I could have wished. English electricians have had rather a surfeit of exhibitions lately. The chief exhibit will be a splendid collection of apparatus in use for the purposes of telegraphy by our post office. I may add that there are some specimens of platinum, etc., in the Mining Section. There are, unfortunately, not many exhibits in the Horticultural Department, but we are fairly to the front in the Agricultural Building. Mr. Burdett-Coutts, M.P., is showing a model of his stud farm, which is certain to interest the sportsmen. Then there is a model dairy and a good selection of baking machinery."

"Do you think the early visitors to the World's Fair can be promised a complete exhibition?"

"Yes; I think matters are progressing so favorably that things will be in working order by the date of opening. I will undertake to say that the British Section will be complete and ready on the first of May. We are going to have a 'British House,' called after her Majesty the Queen."

"As to our exhibits—are they already being erected?"

"Many of them are in the United States or en route, but, so far, I believe they are not placed in the grand buildings which will be their home. I was over in Chicago in July, that being the second time I have visited the city on exhibition business, and expect to go on again in February to organize the British exhibits. I shall probably remain until August. There will be a regular staff to undertake official work on the spot, and I trust we may realize a great success."—*Illustrated London News.*

Citric Acid as a Water Purifier.

The well known chemist M. Girard, chief of the Paris Municipal Laboratory, has lately been engaged in making researches concerning the bacilli of cholera and typhoid fever; in so doing he has once more proved the effects of acids in destroying microbes. He finds citric acid to be the most useful and powerful of all. One gramme, he says, added to a quart of tainted water, will effectively destroy all the microbes that may be in it. Consequently he recommends the use of natural lemonade as an excellent beverage at all times, and especially during epidemics. If necessary, a little bicarbonate of soda can be added as a means of neutralizing the acidity of the lemon.

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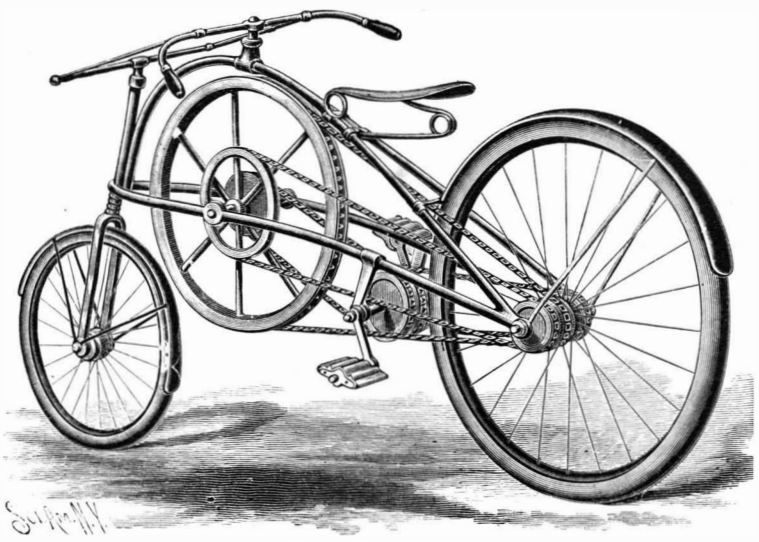
AN IMPROVED BICYCLE.

The system of differential gears provided in the wheel shown in the illustration is designed to enable it to be run very easily at an ordinary rate of speed, or to be run slowly and with great power, or very rapidly, as desired. The main frame has an upwardly curved backbone extending from front to rear, and the driving axle is journaled in hangers depending from opposite sides of the frame. On the axle is a double sprocket wheel of small diameter, a chain from which turns over a small wheel on the hub of the rear wheel,



JENKINS' BICYCLE.

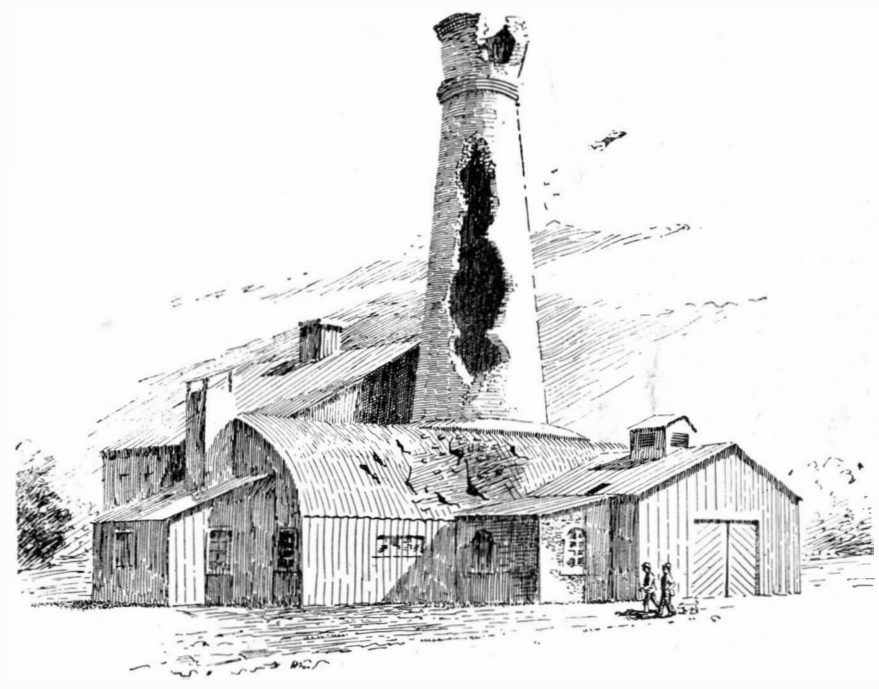
while another chain extending forward from the same wheel drives a small wheel on the hub of a fly wheel. The periphery of the fly wheel also has a chain connecting with a small sprocket wheel on the hub of the rear wheel, and the latter wheel has likewise a sprocket chain connection with a sprocket wheel of intermediate size produced on the fly wheel. This gear arrangement allows for three changes of speed, one rate for slow driving over hilly and difficult roads, one for moderate work, and one for driving as fast as possible, in each case the main sprocket wheel serving as a fly wheel and assisting in keeping up a constant and steady motion.

Further information relative to this improvement may be obtained of the patentee, Mr. Anthony D. Jenkins, in care of H. Bentley, East Walnut Lane, Germantown, Philadelphia, Pa.

LIGHTNING DAMAGES A CHIMNEY.

To the Editor of the Scientific American:

I send you a sketch of the chimney of the Flint Glass Co., of this city (Meriden, Conn.), which was struck by lightning several months ago, on a Sunday morning at 3 A. M. The chimney is the upper part of the furnace where the glass was melted and is about 100 feet high. The hole extends very near the entire length of the chimney. The chimney is considered unsafe, as the bricks are continually falling. You will notice that the bolt struck the top first, then skipped about 15 feet, tearing the bricks out to the base of the chimney, leaving a hole clear through one side of the chimney. There were no lightning rods on the chimney or building. There are no high buildings anywhere near the chimney, although there are a few small outbuildings not over one story high. The roof of the large building is heavy corrugated iron. The chimney is cracked very badly and appears to be very shaky. Coincident with the stroke, the local and long distance telephones were all burned out within a radius of one-fourth mile. FRANK C. WHITE.



A CHIMNEY STRUCK BY LIGHTNING.

Electricity in Surgery and Medicine.

The enormous strides made by the new force in commerce and industries of late years have been, to a certain extent, paralleled by the application of electricity in medicine and surgery. The electric motor turns the drill of the dentist, bores out all the noses of mankind in the hands of the rhinologist, and may run the saw and the trephine of the surgeon. The electric light is made to illuminate all the cavities and interiors of the human body, so that "the pestilence that walketh in darkness" in the black recesses of our viscera is sought out and driven away by the electric search light. It is nothing now to put an endoscope into the stomach and scrutinize its walls from one end to the other, and in a dark room the very size of the stomach is determined by the translumination of the abdominal walls when a light is turned on inside of that viscus.

Electricity furnishes heat for the cautery with which morbid surfaces may be healed, wounds stimulated, and tumors extirpated.

The electrolytic needle removes the hairs of the bearded women, eradicates birthmarks, decomposes tumors, coagulates aneurisms, and in its most romantic role manufactures those most desired ornaments of the feminine physiognomy, lovely dimples.

The electro-magnet pulls out the beam from our neighbor's eye, when the beam is in the shape of a piece of iron, and when the operation is intelligently directed by the ophthalmologist, it may hunt up and draw out wandering needles.

One of the new features of electric medication is the introduction of drugs into the human body through the skin. This is done by placing solutions of any drug upon a sponge, which is made the positive pole and placed against the skin. When the current is turned on, the drug is actually driven through the skin into the tissues. The application is not at all painful. Thus cocaine has been driven in over a painful nerve, and neuralgias have been relieved by it. Many other drugs have been used in this way. This property of electricity is known as cataphoresis. Operations have been performed after anæsthetizing the skin and subjacent tissues cataphoretically.

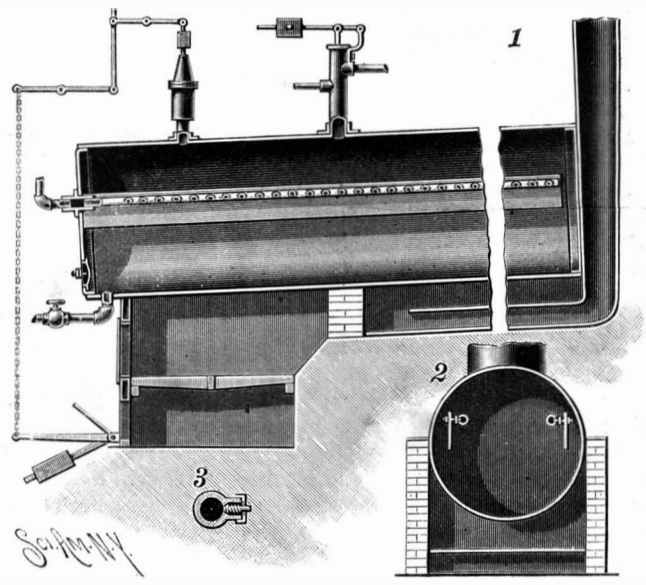
The neurologist, perhaps, finds a large therapeutic field for electrical exploration. With the continuous current he soothes the pains of peripheral nerves, calms down an excited brain, stimulates healthy processes in a diseased spinal cord, exercises paralyzed muscles, rejuvenates overworked limbs, and aids in the rebuilding of tissues in members that have wasted away. Sometimes he calls in to his aid the interrupted and the alternating currents, and occasionally takes into service the static sparks evolved from his big glass wheels and Leyden jars. The method of the working of electricity in disorders of the nervous system is much more obscure than in the maladies mentioned above, where heat, light, electrolysis and cataphoresis produce effects at once apparent to the senses. Not able to demonstrate objectively the value of electricity in some of the chronic nervous diseases, a great deal has to be accepted on faith. There is dispute in some quarters as to its intrinsic value here, and many incline to the idea that suggestion has a good deal to do with improvement in patients of this kind treated in this way.

Besides its employment as a therapeutic agent, electricity has considerable value as a means of diagnosis in many neurological conditions. For instance, the resistance as measured by the rheostat is reduced in exophthalmic goitre and increased in hysteria. The muscular contractions produced in paralysis from injury to certain parts of the nervous system are so different from contractions produced by electricity in paralysis due to lesions in the brain, as an example, that their differentiation constitutes an important aid in distinguishing these affections one from another. Then, too, in the surgery of the brain and spinal cord, which has newly sprung into existence, electric stimulation of parts of the brain and of nerve roots is very valuable in localizing the exact region to be operated upon. Indeed, much of our knowledge of the localization of functions in different parts of the surface of the brain is owing to electricity made use of by physiologists in their marvelous experimental researches in cerebral domains.

Altogether electricity occupies an extensive place in the armamentarium of the physician. All parts of the human economy are explored by its beneficent light, and there is no cell so secretly hidden that it may not be influenced by this wonderful force, which may be made to penetrate skin, muscle, bone, blood, nerves, and viscera. No one can yet place a limit upon its possibilities as a remedial agent, for each year new apparatus, new devices, new forms of current, and new methods are made available to the medical profession in its noble warfare against the diseases which assail mankind on every hand. It is not in vain that man has sometimes looked heavenward for aid in sore affliction, for has not the lightning been drawn from the clouds to become his friend and heaven-born ally? —*N. Y. Sun.*

A NOVEL STEAM BOILER.

In the boiler shown in the illustration the feed water is discharged upon heated plates arranged longitudinally within the shell of the boiler. The improvement has been patented by Messrs. Max and George Hise, of Grahamton, Ky. Fig. 1 is a side sectional view and Fig. 2 a transverse section. The brick work is built around and nearly over the entire boiler shell, within which are longitudinal pipes connected with the feed pipe, and each provided with a series of nozzles for discharging water onto a plate held parallel to the supply pipe, and supported by arms or brackets projecting from such pipe. Each of the nozzles, as shown in detail in Fig. 3, has an inwardly closing valve to prevent the steam in the boiler shell from passing into the supply pipe. The dome of the boiler is preferably in the shape of a tube, from which lead steam pipes, and in the upper end of which is the usual safety valve, and on the boiler top is also a vertical cylinder in which works a piston whose rod is connected by levers and chains with a damper in front



M. AND G. HISE'S BOILER.

of the fire box. When the steam pressure forces the piston outward the damper is closed automatically, opening again as the pressure decreases.

How to Keep Young.

We find this circulating in the newspapers. The author is unknown to us. It contains much truth.

"Past grief, old angers, revenges, even past pleasures, constantly dwelt upon—all dead, decaying, or decayed thought—make a sepulcher of the soul, a cemetery of the body, and a weather-beaten monument of the face.

"This is age.

"The women who never grow old are the student women—those who daily drink in new chyle through memorizing, thoroughly analyzing, and perfectly assimilating subjects apart from themselves.

"Study is development—is eternal youth.

"The student woman who makes wise use of her acquisitions has no time to corrugate her brow with dread thought of the beauty-destroyer leaping fast behind her.

"Not considered or invited, old age keeps his distance. Brain culture, based on noble motive, means sympathy, heart gentleness, charity, graciousness, enlargement of sense, feeling, power. Such a being cannot become a fossil."

THE captains of ships which carry bricks have to be very careful. An ordinary brick is capable of absorbing a pint of water. So with a cargo of brick in the hold serious leakage may quite well go on undetected, for the water that enters is sucked up as fast as it gets in. If this should be the case, the consequences are bound to be most serious.

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THE MARBLE CAVE OF MISSOURI.

(*Continued from first page.*)

not be called such by one familiar with the Alleghanies, the White Mountains, or even the Catskills. No railroad has yet touched the county, the forests of oak, with sycamore, elm and walnut in the valleys, are for the most part in their primeval condition, and thousands of acres of fertile land may still be taken up under the U. S. homestead laws. The forests are free from underbrush and much grass grows under the trees, giving the scenery a park-like aspect.

Mr. Truman S. Powell's claim occupies Echo Glade and the neighboring hills about a mile and a half from the mouth of the cave and about 300 feet below it, and is the best headquarters from which to visit the cavern. Mr. Powell is the editor of the *Stone County Oracle*, published at the county seat, Galena, 18 miles from his farm. He says that he has explored fifty caves in Stone County. He is a firm believer in the future of the county and is an ardent admirer of Marble Cave. His eldest son, William T. Powell, is the good-natured, efficient guide to the cave. He is strong and active and a keen observer whose judgment is very reliable.

Climbing this hill, which is known as Roark Mountain, we saw in its top a large sink hole about 200 feet long by 150 feet wide and 55 feet deep, the bottom of which had dropped out, leaving a yawning chasm opening into the chamber below. Descending a series of log steps in the side of the pit, we came to two short ladders which led through the opening to a platform, from which we descended a large, strong wooden ladder into what seems to be a bottomless pit. This part of the journey is fraught with many imaginary dangers to those unaccustomed to ladders, but our party had received considerable training in entering mines in different parts of the State, and consequently we hastened down without fear, anxious to see what was in store for us. The bottom of the ladder rests upon the top of a mound of debris, about 45 or 50 feet below the platform above mentioned. Climbing down this cone of earth and slabs of limestone, we reached the bottom of the vast room which is called the "Grand Amphitheater,"

Some light comes through the great rift in the roof, which is the bottom of the sink hole, and as soon as our eyes became accustomed to the semi-darkness we could see something of the really grand dimensions of the immense dome in which we stood; but when the room was illuminated by red fire, its full grandeur was revealed. The dimensions as given in the newspaper accounts are greatly exaggerated, but the truth is sufficiently grand. The room is about 150 feet wide by 200 feet long, and the roof rises in a magnificent arch to a height of 165 feet from the floor. Some stalactites were seen on this broad expanse of roof, but the beauty of the scene lay chiefly in the symmetry of the arch and the variations produced by the differences in the limestone strata.

Two beautiful examples of drip formations occur in this great amphitheater. One is the "Great White Throne," a magnificent stalagmitic mass of pure white onyx about 50 feet high, 50 feet in extreme width and 12 or 15 feet in thickness, showing all the beautiful forms which one might imagine to be caused by the freezing of a fountain. It is hollow and one can climb more than half way to the top inside.

A few yards from the Great White Throne rises the "Spring Room Sentinel," a beautiful fluted column of combined stalactite and stalagmite about 20 feet high and from 2 to 3 feet in diameter with swelled base which stands near the opening leading from the Grand Amphitheater to the Spring Room and to the Animal Room. This passage is a long, straight, gradually converging one following a "joint" in the limestone, which leads to a large low room of unknown dimensions which contains the mummified remains of hundreds, even thousands, of animals, mainly, if not entirely, of carnivorous species. Admittance to this room is positively forbidden by the owner of the cave, but the assistants in the Smithsonian Institution at Washington have had access to material from it and are now at work upon their identifications. A specimen from this room which was shown to me consisted of the skull and jaw bones of a cat-like animal to which portions of dried skin and fur still clung. It had a very ancient appearance. The continuation beyond the Animal Room of the joint leading to it seems to emerge in the side of a ravine outside the cave. What was once apparently an opening here is now filled with earth and debris.

Mr. Will Powell thinks that this is the place where the much desired horizontal entrance to the cave can be made with comparatively little trouble and expense.

Opening out from the passageway to the Animal Room is the Spring Room and beyond this lies the "Shower Bath Room," the latter being a perfect example of a conical dome some 30 feet high, down the roof of which the water trickles and flows over a low precipice into the Spring Room. This water showed the remarkably low temperature of 48° F.

Behind the Great White Throne, in the Grand Amphitheater, is a passageway which leads to the waterfall and to other portions of the cave, which will be described as we go on. The first room to which this passage leads is called "The Registry Room," because the walls are covered in places with firm, damp, red clay, in which numerous visitors have inscribed their names with finger or staff—an unstable method of gaining celebrity. Here our guide called our attention to the fact that the atmosphere had become much warmer than it was in the first great chamber. There is, in fact, a difference of six or eight degrees. Then pointing to a great black hole in the floor of the room, he said, "Listen!" and taking a huge rock cast it into the abyss. After some seconds we heard the sound of the rock as it fell into water below us. The abyss is called the "Gulf of Doom." Actual measurement proved this precipice to be 88 feet in height!

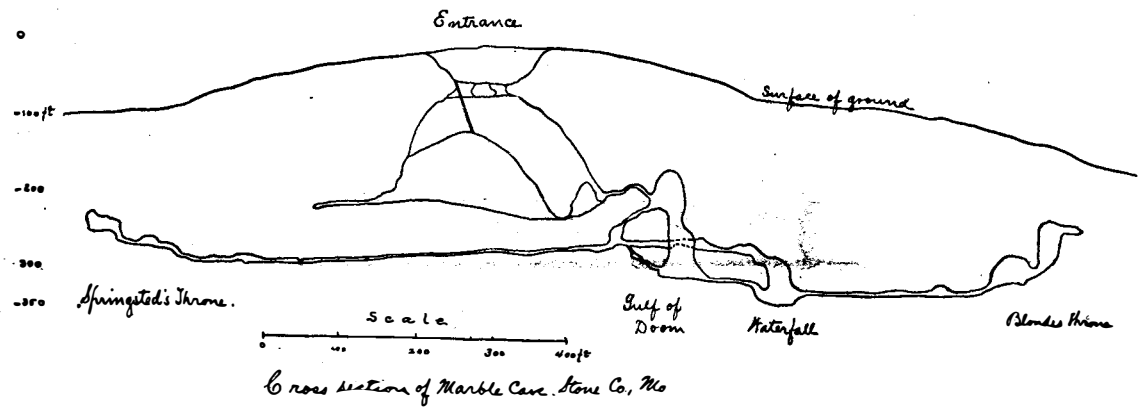
Turning to the left and descending a slippery clay bank and a narrow ladder, we reached a point at which the cave divides, one arm going past a great slab of limestone standing on end, known as "The Lost River Sentinel," in a direction S. 30° W. to "The Lost River Canyon," a journey which we reserved for another day. Taking the other arm, leading in a directly opposite direction, and clambering through two passages like the "Corkscrew" in Mammoth Cave, we soon reached the top of the waterfall. The edge of this fall is about 20 feet across, and the water passes through a series of beautiful little pools with projecting rims of calcite crystals before it takes its final plunge of 50 feet into the darkness. The top of this waterfall is about 285 feet below the top of the hill at the entrance of the cave.

Retracing our steps for some distance from the top of the waterfall and turning on our track again at a lower level, we reached the bottom of the pit (8) into which we had cast the stone from the Registry Room above, and then passed on down a narrow defile by the aid of ladders and over slippery clay banks until we stood at the foot of the beautiful waterfall. Half way down the precipice a projection has caught the spray from the water, and the deposits of ages have formed there a beautiful bowl of carbonate of lime. Pointing to a 25 foot slope of miry clay and water, which lay just beyond us, Mr. Powell said: "That's the way to 'Blonde's Throne,' the prettiest thing in the cave." We looked at the prospect in dismay, and anxiously inquired whether there were no other way to get there; being answered in the negative, we left him behind, as he said there was no need of a guide, and plowed our way through that miry mass, which came to our knees. After toiling up this slope and through a narrow cleft in the rock, we reached the beginning of what they called "The Dry Crawl." We wondered what the *wet* one was going to be. Down we went on our hands and knees and began the toilsome journey. One hundred and fifty feet of this, most of which was too low even for this method of locomotion, brought us to the "Midway Rest," a small room, out of which a passage leads upward to several small chambers, in which were phantastically carved shapes in the limestone. We suggest the name of "The Temple" for one of these chambers, which contains fine Doric capitals. But Blonde's Throne did not lie in that direction. As soon as we had gotten our breath and adjusted our surveying instruments we started on the "Wet Crawl," and *wet* it surely was! We were pretty careful about the first pool, and tried to keep out of the water as much as possible, but when we reached the second pool we saw there was nothing to do but to plunge in and work our way across. After thirty or forty yards of this kind of travel on hands and knees in the water, or worming our way through comparatively dry holes in the rocks, we reached a room at the base of the ascent to our destination. Further progress on the level on which we had come was stopped by a pool of water of unknown extent, known as "Mystic River," spanned at the beginning by a low symmetrical arch of limestone.

A short, steep ascent led us to a great narrow cleft in the rocks about 100 feet high. Following this a short distance, we came to a steep incline of wet, slippery limestone, up which we climbed 25 or 30 feet, then pushing our way through a hole in the wall, barely large enough for our bodies, we were in Blonde's Throne. This is a small room, only about 15 feet in diameter, but it is a gem. It is almost completely filled with beautiful and curious stalactites and stalagmites. Some of the stalactites were in sheet-like folds, and a sufficient number of them give forth musical sounds when struck to enable a skillful musician to play simple tunes. The stalactites here are in all stages of growth, from narrow, hollow tubes, like pipestems, to solid pillars several inches in thickness. A small opening in the side of the room revealed the existence of a room which has never been explored. Rockets fired into it show that it must be a room of large dimensions.

Returning from Blonde's Throne, and slipping and sliding down by the aid of the slimy rope which had helped us up the steep ascent, we reached the bottom of the incline all too soon for some of our party. Lighting up the cleft by magnesium ribbon, we could see weird drip formations filling the crevices and projecting from the walls far above our heads. The return journey to the bottom of the waterfall was made much more expeditiously than the advance, because, being thoroughly wet, muddy, and cold, we did not stop for scenery or surveyor's measurements.

Another day was spent in exploring the windings of the "Lost River Canyon," which, as stated above, lies out to the southwest from the Registry Room. Climbing over huge blocks of limestone which had fallen from the roof, or threading our way between slabs standing on edge, we soon came to the beginning of a much longer but drier crawl than the one just described. After worming our way along for some 200 yards, we came to a beautiful stream of water flowing swiftly through the underground channel which it had carved for itself in the limestone. This was the "Lost River." In several places tortuous passages led out from this canyon, which are barren of interest, and serve merely to confuse the traveler and add to the length of the cavern. Somewhat less than a quarter of a mile from the Registry Room we ascended a steep slope and arrived at "Springsted's Throne." This is a room about as large as Blonde's Throne, but with a smaller amount of drip formation in it. The special feature of the room is a small recess, which is separated from the main portion by a lattice of stalactites. The cave has been explored for about a fourth of a mile beyond this room, but nothing of interest has been discovered in that direction.



Cross section of Marble Cave, Stone Co., Mo.

MAP OF THE MARBLE CAVE, MISSOURI.

The explorations thus far described have been along galleries opening out from only two places in the grand entrance dome. On the north side of the Grand Amphitheater another series of chambers opens out, most of which are comparatively small and devoid of drip formations. The first of these is the Mother Hubbard Room, in which an isolated waterworn pillar of limestone stands which has received the name "She" from its suggestion of Rider Haggard's weird descriptions. A dry crawl of 70 feet from this room takes one to the "Battery," a dome which is 60 feet in greatest diameter and 50 or 60 feet high. Here the bats congregate in vast numbers, whence its name. From one side of the battery a series of rooms, one of which is known as the Dungeon, and low dangerous passages extend to the Grand Amphitheater again.

A low narrow passage leads from the Mother Hubbard Room to the northwest to a series of barren rooms two of which are said to rival the Grand Amphitheater in size. This part of the cave is dry. The second room reached contains considerable amounts of epsomite, $MgSO_4+7H_2O$, and therefore is called the Epsom Salts Room. The passage to these rooms is called the Windy Passage on account of the strong current of air which sweeps through it.

As there were no means at hand of exploring this passage and the dangerous route beyond, we did not undertake to visit it.

In addition to bats the living animals to be found in the cave consist of crickets, newts, and eyeless fish. Plant life is represented by a peculiar white fungus which grows on the rocks in the Grand Amphitheater. Vast numbers of bats make their home in the cave, especially during the winter season, and the floor is covered to a depth of many inches with bat guano. Mr.

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Powell has distinguished five kinds of bats here, none of which, however, are of unusual size or appearance.

That the cave was known to the early settlers and explorers of this region is shown by the notched poles which were found in the cave when it was first rediscovered, and which evidently served as ladders for entrance into the cave. Two of these are now to be seen in the Mother Hubbard Room. Local supposition is that these notched trees were used by the Spaniards, as it is known that they occupied the land in this region before the English settlers took possession of it.

The cave as thus described is of considerable extent and possesses variety in scenery and interest. It is well worth a visit, and when the projected railroads from Aurora and Springfield pass near it, it will undoubtedly become a summer resort; but the estimates of the distances, heights and depths which have appeared in certain usually responsible papers and magazines are very wide of the truth. Its unexaggerated beauties are enough to recommend it to the popular favor. The accompanying map represents, as accurately as the circumstances would permit, almost all of the cave that has been explored. It is certain, however, that the cave is by no means fully explored and that further investigation will add largely to this map. At present even Blonde's Throne and Springsted's Throne are practically inaccessible to the average visitor, but a not excessive amount of work would materially lessen the most serious difficulties in the routes.

My special thanks are due Mr. J. D. Robertson, assistant on the Missouri State Geological Survey, and Mr. H. D. Card, draughtsman for the Missouri World's Fair Commission, for their painstaking assistance in making the accompanying map and measurements and the thermometric determinations that are given herewith. To Mr. Powell and his family is due the credit for almost all the exploration that the cave has received.

An exceptionally low temperature, 48° F., was observed at the lowest point of the Grand Amphitheater and in the air and water of the Spring Room. Throughout the rest of the cavern the temperature seemed to be about that usually found in caves, 54° F.

In considering the scientific value of this cave, the fact should not be overlooked that this is the first cavern reported in this country containing mummified animal remains in large quantities.

North Greenland.

Professor Angelo Heilprin recently gave a very interesting address on "The Scientific Results of the Peary Expedition," illustrated by photographs projected by the lantern, before the Engineers' Club of Philadelphia.

The expedition under Lieutenant Peary did not have for its object, as many erroneously supposed, a nearer approach to the North Pole than had yet been reached, but was planned with a definite object, the determination of the northern boundaries of Greenland, which was carried out with unusual fidelity. The basis of operation was not, as usual, the steamship, but the mainland, and the trip extended from McCormick Bay northeastwardly across the ice cap. The entire return distance—1,300 miles—was accomplished on foot, sledges being used only to carry supplies, etc.

The country was found to be bounded by a chain of mountains on both the eastern and western shores, and the trip started at the western shore at an elevation of from 2,500 to 3,000 feet, and continued rising to the apex of the Humboldt Glacier. The ice cap terminated at about 82° north latitude, and open country followed it northward. The northeastern coast was reached in latitude 81° 37′, about 4½° further north than had yet been discovered. From this point the directions and general character of the coast in both directions were established for a considerable distance, although it could not be closely explored, on account of the rugged basaltic bowlders with which it was everywhere covered. The physical features were found to be quite uniform throughout the country. The mountain ranges averaged about 5,000 feet in height, occasionally reaching 10,000 feet or higher. The basaltic bluffs and bowlders on the coast, and the numerous fiords, made it very similar to that of Norway. Inland, between the mountain ranges, there is an apparently endless sea of ice, entirely covering and hiding the true topography.

The expedition solved the problem of the northern termination of Greenland, by showing that it does not extend to near the pole, or northeastwardly, as has been generally supposed. It was also found that glaciers were projected northward toward the pole, and therefore Greenland could hardly have had any connection with the American ice of the great Ice Age, as has often been supposed by geologists.

A narrow border country, having a good vegetable growth and an animal life identical on the east and west sides, extends all around Greenland. The summer temperature there is about the same as that of a mild winter here; the winters are much colder than in this locality, but not more so than in some of our Western States.

There is a very perfect, but very diminutive, forest growth of birch and willow. Poppies, anemones, buttercups, and other bright colored flowers bloom in favored localities, and butterflies and mosquitoes are abundant.

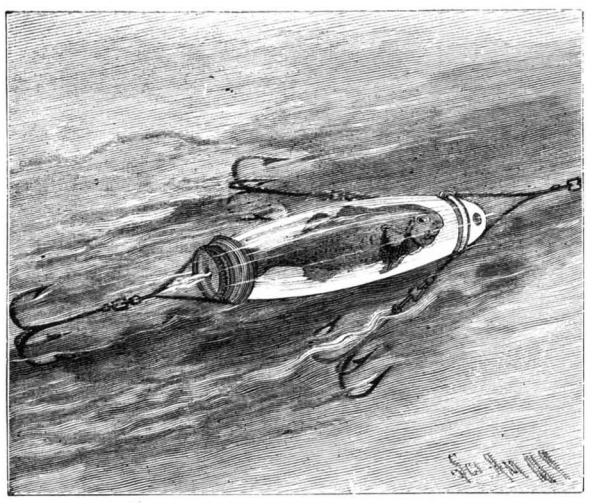
The country, up to the 73°, belongs to Denmark; north of that is No Man's Land, probably because its resources have not made it worth an official claim and protection.

The true Esquimaux are found north of Melville Bay, and now number approximately 250. They seemingly observe no religious forms whatever; they live largely upon uncooked food, are quick of perception and in adapting means to ends, and are absolutely honest.

The expedition to be undertaken next season will attempt to completely locate the northern boundary of the country and to study the open sea beyond.

TROLLING WITH LIVE FISH BAIT.

The improved fishing device shown in the accompanying illustration, and which has been patented by Mr. Henry J. Welch, is designed to keep the bait used alive for an indefinite period. The hooks, instead of being attached to the line in the usual way, are white, and are secured by a swivel and white wire leaders to an annealed, flanged, flint glass tube, through which the water circulates, and in which is held a live minnow, or other living bait, the glass magnifying the size of the fish in the tube, and its effect being such that, at a distance of a foot, only the bait fish in the tube is seen by the fish in the water outside, the hooks escaping observation. An opening in the front of the tube and one in the cap closing its rear provides for a free circulation of water through it, so that one small bait fish may last for a day, the fish being inserted in the tube by unscrewing the rear cap. It is said that this



AN IMPROVED TROLLING DEVICE.

device has been successfully employed in catching muskallonge, pickerel, pike, and bass, being equally adapted for taking either salt or fresh water game fish, whose natural bait consists of small fish.

The tubes are preferably made of different sizes, from 3½ to 5½ inches long, and proportionately trimmed with hooks, according to the kind of fish it is proposed to catch. Further information relative to this improvement may be obtained of Mr. Calvin V. Graves, Natural Bridge, N. Y.

Plaster of Paris Floors.

The French, who have carried the art of hardening plaster to where it is utilized for flooring, either in place of wood or tile, use six parts of good quality of plaster intimately mixed with one part of freshly slaked white lime finely sifted. The mixture is then laid down as quickly as possible, care being taken that the trowel is not used on it for too long a time. The floor, adds the *National Builder*, should then be allowed to become very dry, and afterward be thoroughly saturated with sulphate of iron or zinc, the iron giving the strongest surface, the resistance to breaking being twenty times the strength of ordinary plaster. With sulphate of zinc the floor remains white, but when iron is used it becomes the color of rusted iron; but if linseed oil, boiled with litharge, be applied to the surface, it becomes of a beautiful mahogany color. Especially is this the case if a coat of opal varnish is added.

Paste for Attaching Paper to Glass.

Flour	2 teaspoonfuls.
Water	4 ounces.
Bichromate of potash	5 grains.

The flour must be rubbed to a smooth paste with the water, then placed in a saucepan over the fire and kept stirred until it boils. Add the bichromate slowly, stirring all the time; then stand to cool. The paste must be kept in the dark, and used as soon as possible. Soak the paper in it, and attach to the glass, then place in direct sunlight for a day. This sets up a chemical change in the bichromate, and renders the paste insoluble.

Correspondence.

Nitro-Glycerine Should be Kept from Freezing.

To the Editor of the Scientific American:

How long will the community be startled and appalled by such terrible calamities as occurred recently in a Brooklyn suburb? I answer, just as long as workmen are allowed *to thaw out dynamite.* "But it can't be used in its frozen state." No; but it can be *kept from freezing*, just as easily as ink, or vegetables, or anything else. Dynamite, in cold weather, should be kept in a chest impervious to frost; and any box or chest can easily be made impervious by packing. The legislature of every State where the mercury is liable to fall below freezing should enact a law making it a criminal offense on the part of any one storing or using dynamite *to allow it to freeze.* J. T. PETTEE.

Meriden, Conn., January 2, 1893.

American vs. Foreign Files.

To the Editor of the Scientific American:

I have read Mr. J. D. Foot's answer, in the SCIENTIFIC AMERICAN of January 14, to my note on files. I desire to say that my experience with file *manufacture* is quite small and unimportant; but my experience in the use of files is one of thirty years. This experience teaches me that the files made by Mr. Foot's company are inferior to those of the Stubb's make in at least the degree stated in the note referred to.

It is fair also to assume that Mr. Foot has incorporated his whole file knowledge into his product, and those who are familiar with that product may judge said experience and expertness with little room for doubt, and they may thus gauge his criticism of my note so as to do justice to both of us.

A general expression of the opinions of American users of files on the values of Mr. Foot's files, when compared with the Stubb's files, will teach your readers how these tools generally are considered.

Brooklyn, Jan. 16, 1893. ALBERT D. PENTZ.

The Importance of Auxiliary Water Jet Propulsion for Steamers.

To the Editor of the Scientific American:

Your valuable article on "Safety Suggestions on Ocean Steamers," of January 7, 1893, is very timely and to the point. It should be well pondered and carefully considered by the engineering profession and by the public.

When it is considered that thousands of human lives and millions of dollars of property are risked on the ocean every year, thousands of miles from land, it is a wonder to me that not more precautions are taken to protect life and property, and that not more progress has been made by marine engineers to make steamships superior to wind and water. It seems to me man will master the sea when he will perfect his steamship. He has not done it yet; but if an auxiliary propelling force like water jets were introduced, it would go a long way to make safe and perfected steamships, by giving the vessels a steering and propelling power independent of the screw and shafts. If jets were used with the screw, they would produce increased speed to the vessel; but as a ready protection to a vessel disabled on account of loss of screw or fractured screw shaft, the water jet offers the least expensive and most effectual of any means taken to provide safety for a vessel in such an emergency. With a water jet propeller the vessel is reasonably sure of steering and propelling itself to port, and need not depend on the "hawser" and pay heavy salvage. Then collisions will be less frequent, because bow jets enable the vessel to stop much quicker, and if the government put jets on war vessels, it would find it could maneuver war vessels with jets to a much greater degree than is now the case.

The government should carefully consider the merits of the auxiliary water jet, and if it finds it will protect life and prove valuable in case of loss of the screw or broken screw shafts, then it is the duty of government to enact a law that all steamers and war vessels be provided with the auxiliary method of hydraulic propulsion.

There is no question that water jets will propel a vessel; and as the SCIENTIFIC AMERICAN suggested—by use of the pumps in the ship—an inexpensive means would be at hand to provide a propelling force in case of necessity. Then, no doubt, if the system were adopted it could be greatly improved, and obstacles that now appear could be surmounted. I hope the matter will be taken up, now that you have called attention to the importance of auxiliary water jet propulsion. J. W. H.

Newton, Mass., January 9, 1893.

NICKEL is a modern metal. It was not in use nor known of till 1715. It has now largely taken the place of silver in plated ware, and as an alloy with steel it is superior to any other metal, for it is not only non-corrodible itself, but it transfers the same quality to steel; even when combined as low as 5 per cent it prevents oxidation.

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A Great Military Balloon.

A large dirigible balloon is being constructed at the military balloon works at Chalais-Meudon, under the direction of Commandant Renard. It will be similar in form to the La France of 1884–5, but longer; measuring about 230 feet in length and 43 feet in its greatest diameter. By a new arrangement of motor it is expected to be able to make headway against air currents not exceeding 40 feet per second, or 28 miles an hour. The motor is not fully described, but it will act either with gasoline or the gas of the balloon, giving an effective force of 45 horse power on the shaft. The total weight of machinery, with supply of gasoline, etc., will be about 66 pounds per horse power. Previously it has not been possible to make petroleum motors with a less weight than 150 to 200 kilogrammes per horse power. The screw will be in front, and a large rudder behind; the former will make about 200 turns per minute. The first experiments with this balloon are, it is said, to be made in the early spring.

PERFORMING CATS.

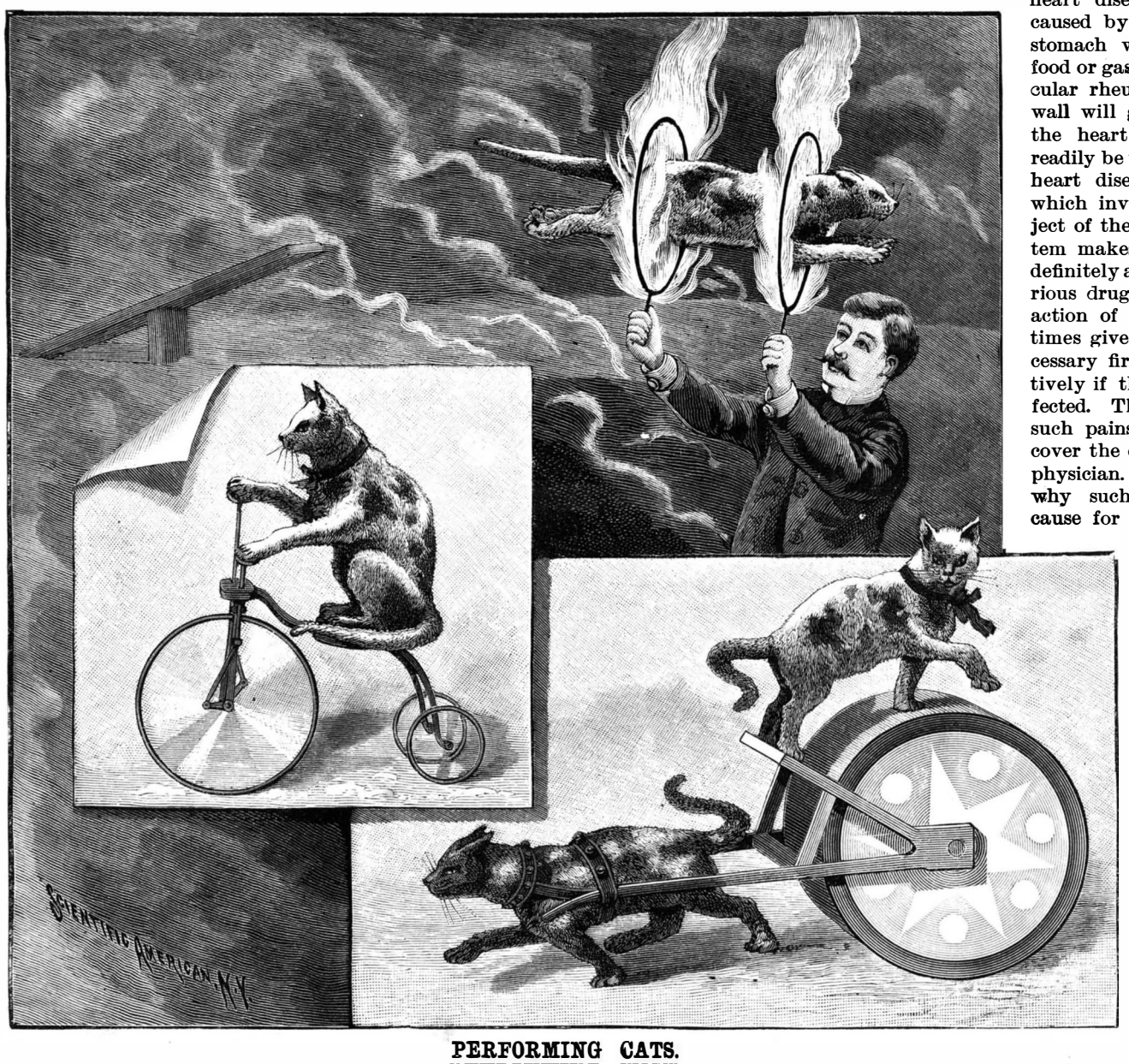
A very remarkable exhibition of performing cats has been produced recently in this city, some features of which we illustrate. As the art of wheeling is now attracting much attention, our performers show how nearly they can come to propelling a velocipede. The cat, it will be noticed, prefers to use her fore feet, much as if a man propelled himself by his hands. The plunger mechanism for reaching the cranks is intelligible from the cut. It is questionable if the cat would not prefer her natural method of progression. She shows no signs of developing into a bicycle crank. The question of dress for wheeling need not agitate the lady cats, Jenness Miller and divided skirts not being within their ken.

Next we see a cat pulling a roller, on which a second cat is riding and working her passage treadmill fashion. By proper application of her energy, it is evident that the rider could do her part in accelerating the progress of the machine. Whether she does so or not, may be doubted.

These two achievements are striking, although somewhat in the line of the ordinary acrobatism displayed by cats in their rambles over roofs and fences. But the third act depicted by our artist shows us our feline friend in a new role, that of fire king. The trainer holds up two hoops which have been dipped in naphtha, which is all ablaze. The cat at the word, starting from a spring board, jumps through the hoops and passes the ordeal unscathed. The jump is repeated a number of times.

The passion of humanity for seeing animals do abnormal things would seem to be gratified in this exhibition. At the same time the training of cats to do these feats really constitutes an achievement and in that sense seems worthy of due recognition.

The above constitute the principal performances, but others are also shown. Thus a wagon load of cats is drawn by their comrades. The performances take place on an oblong table, with large opening in its center where the exhibitor keeps himself.



PERFORMING CATS.

Mails Burned.

In consequence of the recent collision on the Pennsylvania Railroad near Dean's Station, N. J., the mail car was consumed so rapidly that it was impossible to save anything. There was a four-wheel truck load of mail from Philadelphia, destined for New York City, Boston, Springfield, Providence, and intermediate points, and three pouches from Trenton for New York and Jersey cities.

The transfer agents also reported that some of the pouches which should have been received three hours earlier are also missing, and were probably in the burned train. These contained mails from Philadelphia and Baltimore for New York and Brooklyn; also the departmental mail from Washington for New York, Rochester, and intermediate points, besides pouches from Lancaster, Pa., Chester, Pa., and Wilmington, Del., containing mails for this city.

Correspondents of the SCIENTIFIC AMERICAN whose letters prove to be missing should bear in mind these serious losses of mail matter.

A NOVEL TOY.

The annexed engraving represents an amusing toy recently sold on the streets of New York. It is not

THE "MIKADO," A NEW TOY.

particularly scientific, but it shows how a device having little novelty finds sale in places traversed by the multitude.

It consists of the figure of a Japanese in sitting posture, representing the "Mikado." In his right hand he holds a Japanese umbrella, and in his left a fan. The umbrella is provided with a little reel at the top. The stick of the umbrella, in this case, is formed of a tube which is held by the hand of the Mikado, and a spindle attached to the umbrella top and passing through the tube with its lower end resting upon a beveled wheel journaled within the figure. The beveled wheel carries a crank pin working in a slotted arm that extends through the side of the figure and grasps a fan, as shown in Fig. 2. When a cord is wound around the reel at the top of the umbrella, and drawn off after the manner of top spinning, the umbrella spins, giving a rotary motion to the beveled wheel, and the crank pin projecting from the wheel imparts an oscillating motion to the arm carrying the fan. The umbrella being slightly out of balance gives a vibratory motion to the figure, which causes it to rock slightly and turn upon its support.

Aids for Temporary Star Search.

The following extract from a note by Mr. D. E. Packer in *English Mechanic* may be of use to some of our readers:

"During the recent summer months, in our leisure evenings, Mr. Morris, of Cambridge, and myself were engaged in searching the heavens (especially the Milky Way region) for the detection of new stars. In order to expedite our search, we adopted a scheme which, I think, will find favor with those who are similarly occupied on starry nights, and for which we strongly advocate a trial. We used the excellent maps in Schurig's 'Tabulæ Cœlestis,' which give all, or nearly all, stars down to the sixth magnitude. The charts were photographed on quarter plates, and the negatives, backed by tissue paper or an ordinary screen glass, were projected in front of a small bull's-eye lantern. A convenient method was thus obtained of comparing any portion of the chart with its corresponding portion in the heavens. It only required the use of an ordinary magnifier to enlarge any portion of the photographed chart to render comparison easier, and the apparatus was complete. The ease and comfort with which considerable areas of sky were swept over, and the enormous saving of time which this method affords over the ordinary method, a trial will suffice to show. Regions near the zenith were viewed by projection in an ordinary mirror, the photographed chart being correspondingly inverted."

Pains in the Heart Region.

Pains in the region of the heart, says a writer in the New York *Ledger*, are common, and the general dread of this disease makes many people imagine that they have heart disease when there is any local affection in this region. Many who think they are suffering from heart disease have their pain caused by the pressure of the stomach when distended with food or gas. Neuralgia or muscular rheumatism of the chest wall will give similar pains in the heart region, which may readily be thought to come from heart disease. The obscurity which involves the whole subject of the heart's nervous system makes it impossible to tell definitely about such pains. Various drugs, which will slow the action of the heart, will sometimes give relief. But it is necessary first to ascertain positively if the heart is really affected. Those who suffer from such pains can frequently discover the cause better than the physician. There is no reason why such pains should give cause for alarm. Even though neuralgia or rheumatism is causing pain in that region, it is not essentially dangerous. The best plan at such times is to keep in a dry place, avoid draughts of wind, rain or wet weather, and remain in a lying posture for hours. This gives the heart rest and gradually strengthens it. Hot, dry applications over the region are always good. Those suffering from neuralgia and heart disease should always apply hot flannels over the region of the heart when the pain is severe. This will prevent the neuralgia from settling in this organ, the most dangerous spot.

THE municipality of Cadiz, Spain, offers a premium of 30,000 pesetas ($6000) to the author of the best plan for a proposed sewerage system. The competition remains open until December 20, 1893.

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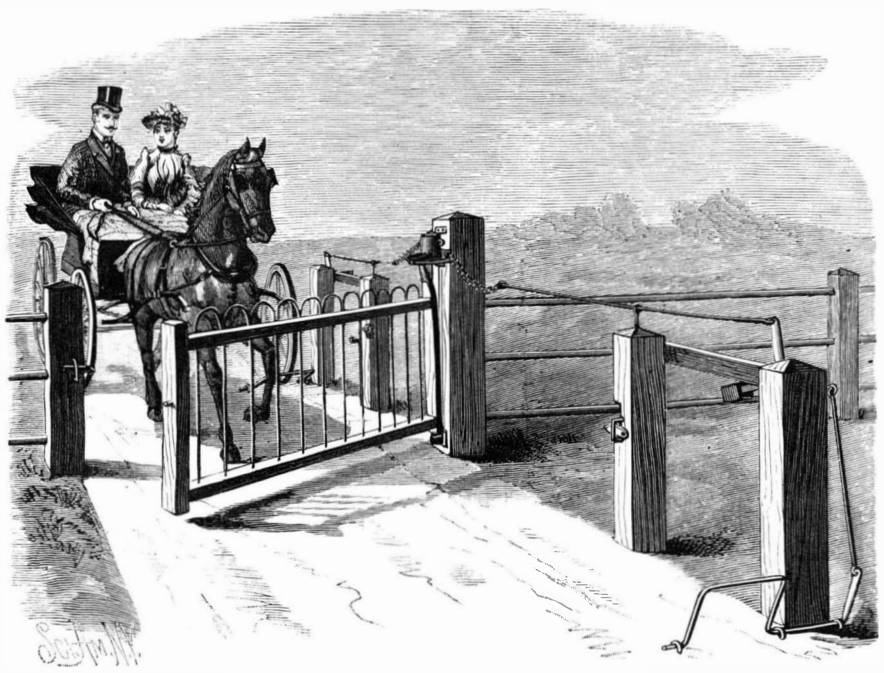
AN AUTOMATIC GATE OPERATING DEVICE.

A gate opening and closing device, which will be automatically operated by an approaching and departing vehicle to open and close the gate, without the necessity of any one getting out of the carriage, or the aid of a gatekeeper, is shown in the illustration, and has been patented by Mr. Silas Portis, of Monrovia, Ind. On a pintle supported by the swing post is pivoted at the bottom one stile of the gate, the upper end of the stile being pivoted in an arm sliding on a curved rod secured to the upper portion of the post, and the



PORTIS' AUTOMATIC GATE WORKER.

arm having an upwardly extending portion embraced by a staple secured to a revoluble drum. The free end of the arm is within a semicircle formed by the curved rod, and the upper pintle of the stile projects through the staple, so that when the latter swings it bears on the pintle and on the upwardly extending portion of the arm. On the drum are reversely wound chains extending to opposite sides, their free ends connected with rods connected at their outer ends in each direction to one arm of a weighted lever pivoted on a post at the side of the road, this lever being connected with a rod bent to form a crank in the path of the wheels of a vehicle. By this arrangement, when the chain at one side is pulled, as by the pressure of a vehicle wheel on the first crank, the drum is revolved in a direction to open the gate, and when the chain at the other side is pulled, from the pressure of the vehicle wheel on the second crank, the drum is revolved in the opposite direction to close the gate. The latch gate post has a recess in its side next the gate in which enters a lug on the outer edge of the gate as the latter is swung open, there being a central stop in the recess against which the lug strikes, and on opposite sides of the post adjacent to the recess are latches which swing in vertical keepers. Alongside the carriage way also are posts with similar latches to engage the free end of the gate when it swings open. As the approaching vehicle operates the crank and the chains are pulled, the combined movements of the arm and pintle swing the upper portion of the stile so as to raise the free end of the gate and lift the lug over the latch, swinging the gate open, when it automatically latches, or similarly closing it as the vehicle passes over the second crank.

Further information relative to this improvement may be obtained of Messrs. Taylor & Bennett, Monrovia, Ind.

TO DARKEN OAK.—Oak for decorative work is produced by fumigating the material with ammoniacal vapor, which effectively produces the dark coloring so much desired. In accomplishing this, the method consists in placing the material to be darkened in an approximately air-tight room in which no light enters; or for small work a packing box will suffice, the joints or cracks to be well pasted over with paper. In this room or receptacle for depositing the furniture or other articles is placed a flat porcelain or earthen vessel filled with ammonia, the vessel containing the liquid being, of course, set on the ground or floor, that the fumes or vapor may strike to advantage the articles to be darkened; if the apartment is large, two or more vessels containing ammonia may be employed, and allowed to remain until the desired effect is secured. The ammonia does not touch the oak, but the gas that proceeds from it acts in a peculiar manner upon the tannic acid contained in the oak, browning it so deeply that a shaving or two may actually be taken off without removing the color. The depth of shade depends upon the quantity of ammonia used and the duration of exposure.

SNOW SHOE EXERCISE IN THE GERMAN ARMY.

There are now being made in certain corps of the German army some very interesting experiments relative to the introduction of snow shoes, to permit of marching and service on a campaign in the severest weather.

The snow shoes used by the German soldiers are the same as those that have been employed for centuries in the countries of the north of Europe—Norway, Lapland, etc. They consist, as may be seen from our engraving, of a thin strip of wood about a yard in length, a little wider than the foot, turned under and curved at the extremity and shod with iron. Every one uses them in Norway, and the results obtained are truly wonderful. During the deepest snows the rural postman owes to them the possibility of continuing his service, not only without delay, but with amazing rapidity. The hunters of the country, provided with snow shoes, pursue the hare and dispatch it with a simple blow of the cane. The Norwegian soldiers, it is unnecessary to say, could not remain strangers to this national sport. So, since the middle of the last century, there has existed in their country companies of light infantry broken in to marching on snow shoes and capable of rendering the greatest services in case of a winter campaign. At present all the Norwegian corps of infantry annually perform maneuvers upon the snow with the aid of these shoes, and, in their cantonments, even get up racing matches on snow shoes.

The foot soldiers of the Dutch army are exercised in the same way upon the frozen canals that abound in their country.

Finally, in the Russian army, certain corps (the sharpshooters of the imperial family and the Finnish sharpshooters) are provided with analogous snow shoes.

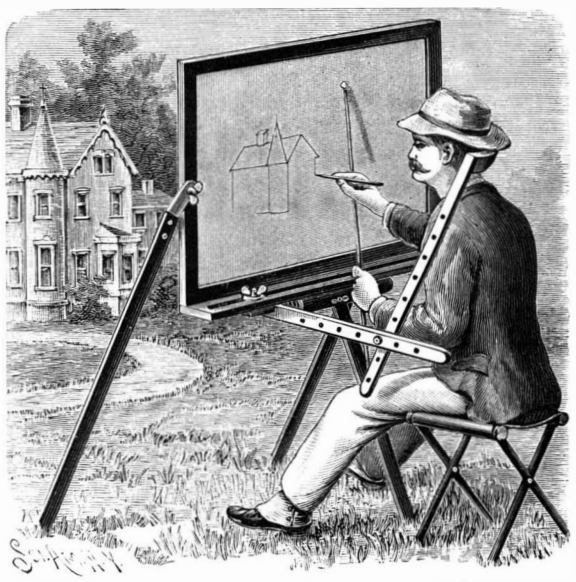
Not wishing to remain in a state of inferiority in this regard, in face of his neighbors, the Emperor of Germany has had snow shoes tried in the Eighty-second regiment of infantry, stationed at Goslar, upon the confines of Hanover and Brunswick.

A model platoon, composed of non-commissioned officers under the direction of an officer, has been trained in the use of the snow shoe, and, thus shod, has executed long marches in the mountains near the city, and all the imitations of battle possible.

Our engraving represents one of these exercises, the platoon making a march forward in battle.—*L'Illustration.*

AN IMPROVED SKETCHING APPARATUS.

The device shown in the picture, to facilitate drawing in correct perspective, forms the subject of a patent issued to Mr. Thomas A. McFarland, of Portland, Oregon. The glass plate on which the sketching is done is cross-ruled with lines so close together that they can hardly be counted, producing a ground glass drawing surface with transparent sight spaces. The plate is inclosed in a frame, to the ends of which are pivoted metallic strips, by means of bolts and wing nuts, the other ends of the strips being bent backward and attached to wooden legs. On the under edge of the frame is a slotted bar in which are eyes to receive a roller to which is clamped an adjustable central leg. To this slotted bar is also clamped an arm on which a head rest is adjustably held, the head rest being thus made adjustable both vertically and horizontally. The sketching thus effected by pencil or crayon on the glass surface may be afterward traced off on tracing paper or cloth.



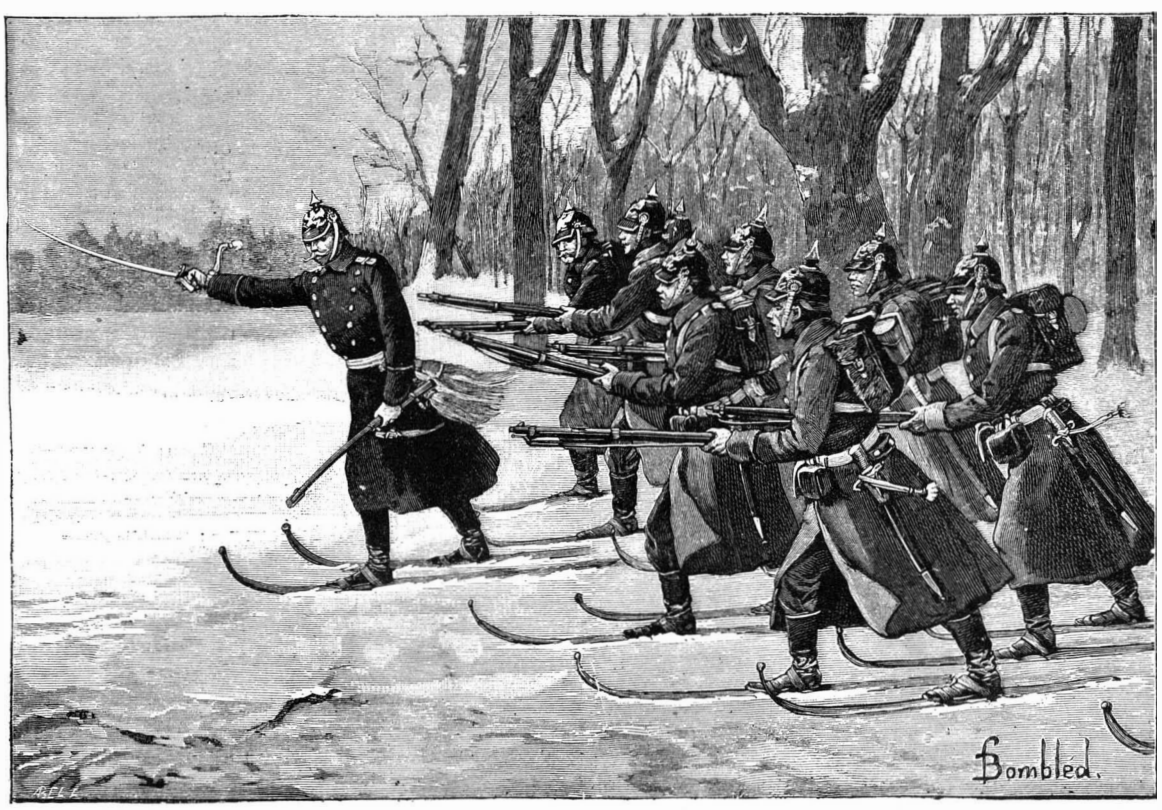
McFARLAND'S SKETCHING DEVICE.

Perfume in Flowers.

1. The essential oil is generally localized in the epidermic cellules of the upper surface of the petals or the sepals. It may exist on both surfaces, especially if the parts of the flower are completely hidden in the bud. The lower surface generally contains tannin or pigments derived from it.

2. Chlorophyl seems in every case to give rise to the essential oil. The transformation is easily understood if we admit, as it is now generally done, that the parts of the flower are merely leaves modified for a new function. The chlorophyl is thus turned away from its object, and is transformed either into persistent tannin derivatives or into essential oils.

3. The development of the perfume of the flower is not perceptible until the essential oil is sufficiently liberated from the intermediate products, and it is present to some extent in an inverse proportion to the production of tannin and of pigments in the flower. This will explain why flowers with green petals have no odor; why white or rose-colored flowers are most frequently odoriferous; why the Compositæ, which are rich in tannin, have their well known disagreeable odor. —*E. Mesnard.*



SNOW SHOE EXERCISE IN THE GERMAN ARMY.

A Noble Woman's Worthy Act.

Mrs. D. W. Bishop, a wealthy lady of this city, sent her check to this office a few days ago for $107.50, with instructions to furnish a copy of the SCIENTIFIC AMERICAN to every police office in the city during 1893. There are forty-three stations, including the five attached to our public parks.

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POSITION OF THE PLANETS IN FEBRUARY.

JUPITER.

is evening star. He is still the brightest star in the heavens, though closely approaching the sun, and soon to be eclipsed in his rays. He makes his transit, on the 1st, at 4 h. 21 m. P. M., is well down in the west when it is dark enough for the stars to come out, and disappears from view about an hour before midnight. His course during the month is uneventful. He is moving eastward or in direct motion, his path lies in a portion of the heavens singularly destitute of bright stars, and he therefore has the field to himself. He is more impressive for this reason, as there are no rivals with whom he must share the honors of the portion of the celestial abode he now occupies.

The moon, when four days old, is in conjunction with Jupiter, on the 20th, at 9 h. 48 m. A. M., being 29′ north. The conjunction is a close one, but as it occurs in the daytime is invisible. The moon occults Jupiter at the same time for observers who see her under the right conditions. The limiting parallels are 73° north and 17° south.

The right ascension of Jupiter on the 1st is 1 h. 14 m., his declination is 6° 37′ north, his diameter is 36″, and he is in the constellation Pisces.

Jupiter sets on the 1st at 10 h. 44 m. P. M. On the 28th he sets at 9 h. 23 m. P. M.

MARS

is evening star. He is moving eastward, or in direct motion, and his distance from Jupiter is increasing. On the 1st they are 3° apart, and on the 28th they are 15° apart. The diameter of Mars, when in opposition on August 4 of last year, was 39″. It will be 5″.8 at the end of the month, showing how greatly Mars has decreased in dimensions as he recedes from the earth.

The moon is in conjunction with Mars, when five days old, on the 21st, at 8 h. 52 m. A. M., being 5′ south. There will be an appulse, the ruddy planet touching the northern horn of the crescent, but the conjunction cannot be seen, for moon and planet are below the horizon.

The moon will be near and approaching Mars on the evening of the 20th, when the finest celestial picture of the month will be on exhibition. The four days' old crescent is then in line with, and midway between, Mars and Jupiter, with Mars on her left and Jupiter on her right, each planet being about 7° distant. The trio, consisting of the moon with a bright planet on each side, remains visible in the west for about five hours, and then disappears below the horizon. Jupiter breaks up the party, setting at 9 h. 44 m. P. M., the moon follows at 10 h. 17 m. P. M., and last of the trio, Mars is seen no more, setting at 10 h. 49 m. P. M.

The right ascension of Mars, on the 1st, is 1 h. 27 m., his declination is 9° 33′ north, his diameter is 6″.7, and he is in the constellation Pisces.

Mars sets on the 1st at 11 h. 8 m. P. M. On the 28th he sets at 10 h. 54 m. P. M.

SATURN

is morning star. This means that he is on the western side of the sun, though he is above the horizon early enough to be considered an evening star. Saturn continues to retrograde or move westward. He is the only one of the large planets that is approaching the earth, as Jupiter, Venus and Mars are all approaching the sun. He rises at 9 o'clock on the middle of the month, and may then be looked for in the southeast, about ten o'clock, between Regulus and Spica and a little distance east of Gamma Virginis. He presents an interesting appearance in the telescope, for the ansae or handles of his rings are clearly defined, and the rings are separating from the body of the planet. He is not specially brilliant in the heavens at this time to the unaided eye of the observer, on account of the proximity of his rings, his increasing southern declination, and his slow advance toward aphelion, which he will not reach until 1900.

The moon five days after the full is in conjunction with Saturn, on the 5th, at 0 h. 16 m. P. M., being 1° 2′ south. Moon and planet are below the horizon when the conjunction takes place, but will not be far apart when they rise about 10 o'clock in the evening. The moon will occult Saturn for observers who see her in her geocentric position and are between the limiting parallels of 18° and 90° south.

The right ascension of Saturn on the 1st is 12 h. 51 m., his declination is 2° 40′ south, his diameter is 17″.3, and he is in the constellation Virgo.

Saturn rises on the 1st at 10 h. 4 m. P. M. On the 28th he rises at 8 h. 12 m. P. M.

MERCURY

is morning star until the 16th, and then evening star. He is in superior conjunction with the sun on the 16th at 2 h. 55 m. P. M., changing his position from the sun's western to his eastern side, and ranking with the evening stars.

The moon on the day of her change is in conjunction with Mercury on the 16th at 9 h. 3 m. A. M., being 2° 14′ south. The conjunction of the moon and Mercury, the new moon, and the superior conjunction of Mercury and the sun occur within a few hours of each other.

NEPTUNE

is evening star. He is in quadrature on the 26th at 3 h. 42 m. P. M., when he is 90° east of the sun, and is on the meridian at midnight.

The moon is in conjunction with Neptune on the 23d at 4 h. 5 m. P. M., being 4° 50′ north.

The right ascension of Neptune on the 1st is 4 h. 28 m., his declination is 20° 12′ north, his diameter is 2″.6, and he is in the constellation Taurus.

Neptune sets on the 1st at 2 h. 53 m. A. M. On the 28th he sets at 1 h. 6 m. A. M.

VENUS

is morning star. There is little to say of her, excepting that she is near the sun, rising an hour before him on the first part of the month and half an hour before him on the last part of the month.

The moon, two days before her change, is in conjunction with Venus on the 14th at 7 h. 42 m. P. M., being 4° 31′ south.

The right ascension of Venus on the 1st is 19 h. 30 m., her declination is 21° 58′ south, her diameter is 11″.2, and she is in the constellation Sagittarius.

Venus rises on the 1st at 5 h. 58 m. A. M. On the 28th she rises at 6 h. 1 m. A. M.

URANUS

is morning star. He will soon be near enough to the earth to be visible to the unaided eye.

The moon is in conjunction with Uranus one day after her last quarter, on the 9th, at 8 h. 29 m. P. M., being 1° 22′ south.

The right ascension of Uranus on the 1st is 14 h. 34 m., his declination is 14° 36′ south, his diameter is 3″.6, and he is in the constellation Libra.

Uranus rises on the 1st at 0 h. 34 m. A. M. On the 28th he rises at 10 h. 44 m. P. M.

Mercury, Jupiter, Mars, and Neptune are evening stars at the close of the month. Saturn, Venus, and Uranus are morning stars.

Honor to M. Pasteur.

On Dec. 27, 1892, all that is famous in French science, diplomacy, and politics assembled at the new Sorbonne, Paris, to celebrate the seventieth birthday of the great chemist and scientist, M. Louis Pasteur. The audience was a particularly distinguished and cosmopolitan one. It included the President of the Republic, his Excellency the Marquis of Dufferin and Ava, and other leading ambassadors accredited to France. English science was represented by Sir Joseph Lister, Sir Henry Roscoe, and Professor Ray Lankester. In opening the proceedings, M. Charles Dupuy, the Minister of Public Instruction, referred to the gathering as a scientific solemnity and a red letter day alike for France and humanity. Addressing M. Pasteur, he referred to him as follows:

"Victorious to-day over hydrophobia; to-morrow, perhaps, over cholera! Henceforth the formula is definite and complete, your disciples give it in two words: Fermentation and virus are living beings, vaccine is an attenuated virus, medicine has for its basis the artificial attenuation of virus. Thus obtaining the remedy from the evil itself, the microbian medicine has been founded!" The Secretary of the Academy of Sciences, M. Bertrand, who is also a member of the Pasteur Institute Council, referred to Pasteur's numerous successful researches, and M. Daubbie, also of the Institute, reminded the audience that it was as a mineralogist that M. Pasteur first attracted public attention. Sir Joseph Lister spoke on behalf of the English deputation, and many other addresses were delivered. On rising to reply, M. Pasteur was much affected by the emotion he evidently felt. He merely uttered a few words of thanks and then handed his son a written reply to read. In it reference was made to the advantages now enjoyed by those wishing to pursue scientific studies, as compared to when he was a young man. He spoke very appreciatively of the arrangements made for the ceremony, which tended to remind him of his past life. The deepest joy a man can feel, he said, was brought to him by the cosmopolitan nature of the audience. It taught him to believe that science and peace can triumph over ignorance and war. M. Pasteur was loudly cheered when his reply had been read, and as he left the Sorbonne he was the object of a popular manifestation. He afterward held a reception at his own house.

Photo Plates of Wonderful Sensitiveness.

At a meeting of the Mathematical and Natural Science Section of the Imperial Academy of Sciences of Vienna, on November 10, Professor V. von Lange presented the following communication from the engineeer Victor Schumann, of Leipzig:

The photographic energy of the ultra-violet rays on collodion and gelatin plates decreases strikingly at the wave length 200 $\mu\mu$, and falls off to a similar extent toward the more refrangible side. The cause of this decline in energy lies in the fact which I have established spectrographically: 1. In the impermeability to light of the collodion and gelatin, in which the sensitive ingredient of the coating of the plate, *i. e.*, the silver haloid, is embedded; and (2) in the impermeability of the air which the rays have to traverse on their way to the plate. If we remove these two absorbents the silver haloid shows itself many times more sensitive for the rays beyond 200 $\mu\mu$ than it was in presence of the collodion and gelatin, and the photographic efficacy extends far beyond the previous limit of the ultra-violet light (wave length 185·2 $\mu\mu$). The production of a film of pure silver haloid on the plate offers great difficulties. A method for this purpose was hitherto not known. After numerous experiments I found a process by which I have now for two years prepared all the plates which I have required for observing the rays beyond the wave length 185·2 $\mu\mu$. The air could only be removed from the rays by exhausting the spectrograph. In this manner I have hitherto been able to follow about twenty different spectra far beyond 185·2 $\mu\mu$. All of them develop here an unexpected wealth of rays, but none to so high a degree as the hydrogen light of the Geissler tube. I estimate the number of the hydrogen lines which I have isolated at 600, and the shortest of their wave lengths at 100 $\mu\mu$. I have not as yet effected the measurements, for which, however, I have already made preparations. For illustration the speaker exhibited a tableau composed of H. V. Schumann's original plates, showing the portion of the ultra-violet hydrogen spectrum first photographed by the latter.—*Chem. News.*

ARMADILLOS AND AARD-VARKS.

BY R. LYDEKKER, B.A. CANTAB.

Of the three animals represented in the figures accompanying the present article, two are sufficiently alike to suggest to the ordinary observer their relationship to one another, but the third is so utterly different that it is difficult to point out any important character it has in common with the two others; nevertheless, naturalists generally regard all these three strange creatures as belonging to a single order of mammals, for which the name of Edentata is adopted. The signification of the term Edentata being toothless, the unsophisticated student would naturally be led to suppose that all the animals so named were utterly devoid of those useful but troublesome appendages. This, however, is far from being the case, the majority of the members of the group (among which are those figured here) having a considerable number of teeth. Still there is one feature in connection with the dentition exhibited by the whole of these so-called edentates, and this is that teeth in the front of the jaws, corresponding to the incisors of other mammals, are totally absent.

The mammals thus associated by these negative characteristics are now chiefly confined to the southern hemisphere, and include the sloths, anteaters, and armadillos of South America, the pangolins or scaly anteaters of Southeastern Asia and Africa, and the aard-varks of Africa, the true anteaters and pangolins being those in which teeth are wanting. In past times they were also represented by the gigantic megathere, and a number of other allied extinct forms ranging throughout America, which in some respects serve to connect the sloths with the anteaters. This marked restriction of the existing edentates to the southern hemisphere, and their special abundance in South America, at once stamps them as a very lowly group of animals, there being a well marked tendency for the preservation of the humbler forms of life in the southern continents and islands of the globe.

Of the three groups of termite-eating edentates, two—namely, the pangolins and the anteaters—are those which have entirely lost their teeth, while in the aard-varks those organs are retained. As teeth are obviously of no sort of use to animals subsisting on such a diet, we may regard the two former groups as those most specially modified for their particular mode of existence, and it may thus be suggested that they have taken to termite eating for a longer period than the aard-varks.

The armadillos, as their name (a Spanish one) implies, are distinguished by the solid armor with which their heads and backs are protected, and it is doubtless the peculiar appearance presented by these animals to which we owe the expression "hog-in-armor." In all the armadillo family the armor takes the form of a series of thicker or thinner bony plates embedded in the skin covering the head and back, and overlain by horny scales, while the under parts of the body and limbs are hairy, and in many species a larger or smaller number of stiff hairs protrude from between the joints of the armor. This bony armor is a perfectly unique feature among existing mammals, and since each plate is ornamented with a more or less elaborate sculptured pattern, such armor when cleaned by maceration forms a most beautiful object. In the true armadillos, as the one represented in Fig. 1, the shield of armor covering the head is quite distinct from that of the body, while the latter is divided into three distinct portions, namely, a large solid shield covering the forequarters, and separated by a larger or smaller number of free movable bands occupying the middle of the body from a nearly similar shield protecting the hinder portion of the animal. In our figured example the number of the movable bands is only three, but they may vary from six to

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nine up to as many as twelve or thirteen in other species. In one extinct armadillo there were, however, no solid shields, the whole body being covered by a series of thirty-two movable bands. The latter species evidently, therefore, leads on to the rare and beautiful little creature represented in our second illustration, which rejoices in the name of pichiciago. In this tiny animal, which is only about five inches in length, and has a pink colored armor above, and long silky white hair below, the armor of the head and body forms a continuous shield of horny plates underlain by very thin plates of bone, and is attached only to the middle line of the back, so that the lateral portions form a kind of cloak loosely overhanging the hairy sides of the body. The hinder end of this cloak is abruptly truncated, and beneath it the hind quarters of the animal are protected by a solid bony shield, through a hole in the center of which protrudes the small cylindrical tail. When the animal creeps beneath a crevice in rocks, as shown in the right hand corner of our illustration, which is not sufficient to conceal its whole body, the strong shield on the quarters affords an ample protection against all attacks. The pichiciago is found on sandy plains only in the western portions of the Argentine pampas. It will be seen from our illustrations that this creature also differs from the true armadillos in the absence of the large external ears which form such a characteristic feature in the physiognomy of the latter.

Reverting to the true armadillos, we find that the majority of the species protect themselves from attack by squatting on the ground, and tucking their limbs within the shelter of the edges of the armor of the body, while the plated head is drawn as close as possible to the front shield. On the other hand, the species represented in our illustration has the power of rolling itself up into a complete ball, like the pill-millipedes of our own country, the wedge-shaped head and tail fitting most perfectly side by side into the deep notches of the front and hind shields. Thus coiled up, the three-banded armadillo is safe from most animals except man. Trusting in this immunity from attack, this armadillo, together with two other species inhabiting the Argentine, has become almost exclusively diurnal in its habits. These diurnal habits, as Mr. W. H. Hudson, in his charming work, "The Naturalist in La Plata," suggests, may also have had the advantage of avoiding any encounters with the larger animals of prey, which are mostly nocturnal, and some of which may have been able to break through the protecting armor, more especially in the species which lack the power of rolling themselves up. Whatever advantage may have formerly accrued from these diurnal habits before the appearance of man on the scene is, however, now completely lost in cultivated districts, where these species stand a good chance of being completely exterminated by the hand of man.

On the other hand, the six-banded pelado, or hairy armadillo, of the Argentine, which differs from its cousins in preferring an omnivorous diet to one of insects, is a far wiser beast in its generation. This creature, according to Mr. Hudson, adapts itself to the conditions under which it exists, and thus stands a good chance of surviving when its fully armored relatives perish. "Where nocturnal carnivores are its enemies," writes the observer mentioned, "it is diurnal; but where man appears as a chief persecutor, it becomes nocturnal. It is much hunted for its flesh, dogs being trained for the purpose; yet it actually becomes more abundant as population increases in any district." Another writer says that beneath any decomposing carcass lying in the Argentine pampas, the burrow of a pelado is almost sure to be found; and it is not a little remarkable that the flesh of a creature which has such unpleasant tastes in the matter of diet should be so eagerly sought after as an article of human consumption.

Before taking leave of the pelado we must not omit to mention two other peculiar habits which are recorded of it by Mr. Hudson, since these also mark it as a creature far above the generality of its kind in point of intelligence. The first of these peculiarities is the ingenious way the creature catches mice, by approaching them with extreme caution, raising itself on its hind quarters, and then suddenly proceeding to "sit down" on the unfortunate rodents, which become entrapped under the projecting edges of its armor. The sharp edges of the armor are also brought into requisition when this armadillo attacks a snake preparatory to devouring it; the snake being pressed close to the ground beneath the edges of the bony plates, and literally sawn to death by means of a backward and forward motion of the body of its assailant.

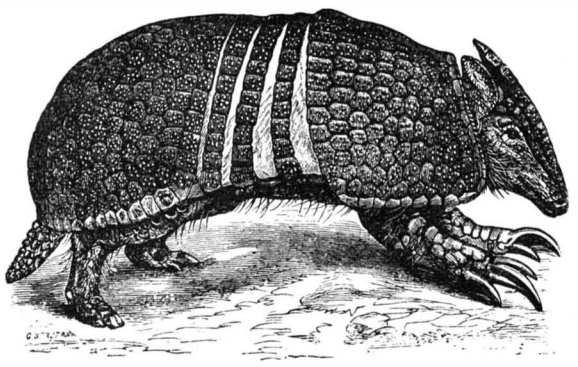

Fig. 1.—THREE-BANDED ARMADILLO.

The largest of living armadillos is one which inhabits the moist forests of Brazil and Surinam, and has a length of about 36 inches, exclusive of the unusually long tail, which is some 20 inches in length. These dimensions were, however, vastly exceeded by some extinct armadillo-like animals, of which the remains are found in the caverns of Brazil. The most gigantic of these creatures, which flourished during the Pleistocene epoch—the period *par excellence* of giant mammals—is estimated to have been nearly equal in size to a rhinoceros, and has been named the chlamydothere. The armor appears to have been very like that of the true armadillos, but the bony plates measured as much as five and six inches in length, in place of little more than an inch. The teeth differed, however, from the simple conical ones of the modern armadillos, and more nearly resembled the vertically fluted ones characteristic of the extinct glyptodonts. Unfortunately, space does not admit of further reference to the gigantic creatures from the Pleistocene of South America, to which the latter name has been applied, all of which are distinguished from the armadillos by the armor of the body being welded into a single solid dome-like shell, of which a specimen is figured in the article on "Mail-Clad Animals."

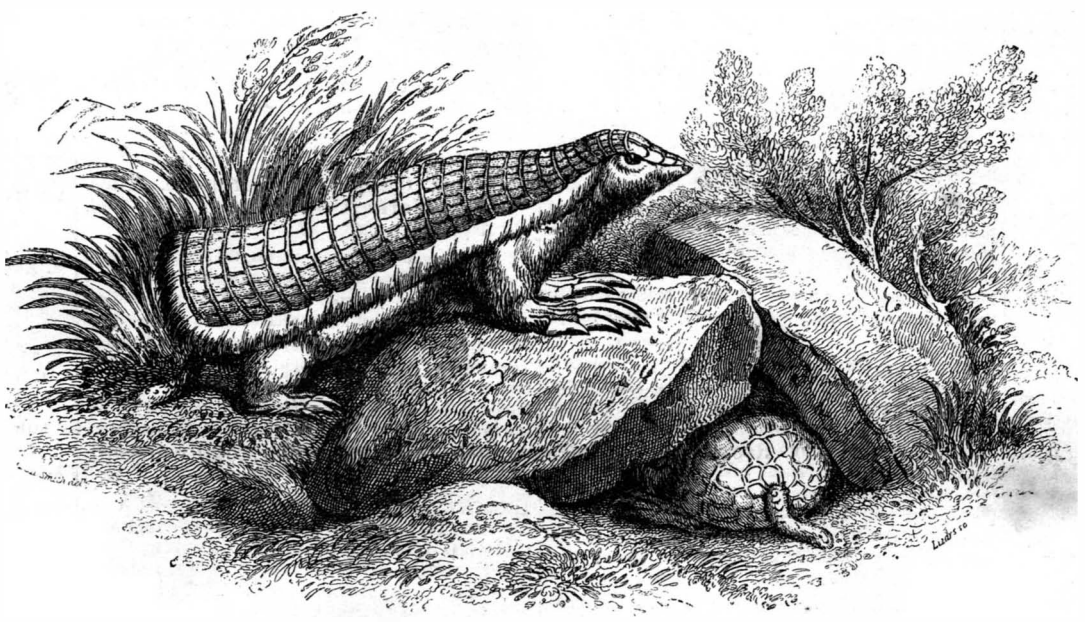

Fig. 2.—THE PICHICIAGO. (From Jardine.)

Passing on to the animals whose name comes second in the title of this article, we have first of all to mention that the designations by which these creatures are commonly known exhibit that remarkable want of originality in nomenclature which appears to be characteristic of Europeans when they are brought for the first time into contact with hitherto unknown animals. Thus, whereas the Dutch Boers of South Africa applied to the creatures in question the title of "aard-vark" (meaning "earth pig"), the English colonists of the Cape commonly speak of them as the ant bear. Now, if there is any one particular animal which the aard-vark (as we must perforce term the creature) is unlike, it is a bear; while its resemblance to a pig is only of the most distant kind. Still, however, as in the case of the order to which it belongs, we must be content to designate the animal by the name by which it is most commonly known.

In appearance, aard-varks, of which there are two species, are decidedly ugly creatures, having thick, ungainly bodies, a long pointed snout, enormous erect ears, and a thick cylindrical and tapering tail, nearly as long as the body. The skin is either almost naked or thinly covered with bristle-like hairs. The fore feet have but five toes, which are armed with broad and strong nails, as are the five toes of the hind limb. As we have already mentioned, almost the only feature which the aard-vark has in common with the armadillos is the absence of front teeth, and its cheek teeth are quite unlike the simple ones of the latter, as, indeed, they are dissimilar to those of any other mammals.

Of the two living species of aard-vark, one is confined to South Africa, while the other (represented in our figure) inhabits part of Egypt and other districts in the northwestern portion of the same continent. A third species occurs fossil in the Pliocene deposits of the isle of Samos.

Aard-varks lead what would seem to us a very dull and monotonous kind of life, passing the whole of the day curled up in their deep burrows, which are generally excavated hard by the tall pyramidal hills made by the termites, and only issuing forth at night to dig in the mounds for their favorite insect food. Not a great many years ago it used to be said at the Cape that wherever a clump of termite hills was to be seen, there an aard-vark's burrow might be pretty confidently expected. Unfortunately, however, as we learn from a recent report of the agricultural department of the Cape Colony, this is no longer the case, and the aard-vark of that district runs a good chance of being exterminated at no very distant date.

This deplorable result is being brought about by the incessant pursuit of these animals by the natives for the sake of their hides and flesh, and also to their being dug out by Europeans for so-called sport. Their flesh is said to be excellent, and is compared to superior pork; while the value of each hide is about fifteen shillings. This threatened extermination is a very shortsighted policy on the part of the South African farmers, to whom the aard-vark (as the report before us points out) is a valuable ally, not only on account of the enormous number of termites it consumes, but likewise from the circumstance that while it is engaged in digging for these insect pests it covers with loose earth a quantity of the seeds of grass and other pastoral herbage which would otherwise perish during the hot season. Although there is no likelihood at present of the Ethiopian aard-vark sharing the threatened fate of its southern cousin, yet the extermination of the latter would be a sad loss to zoological science, and we therefore wish every success to a movement which we hear has been set going by the Cape Farmers' Association for the protection of this most strange and curious creature ere it be too late.—*Knowledge.*

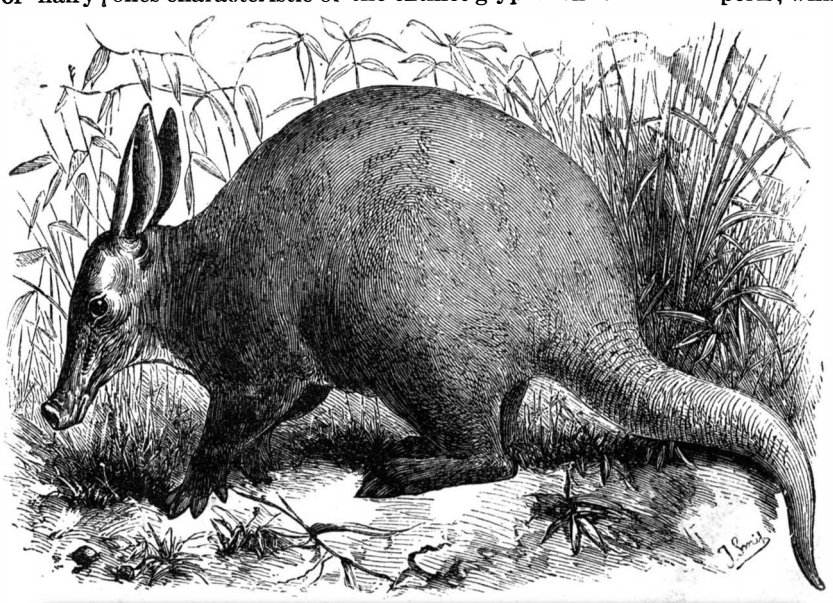

Fig. 3.—THE ETHIOPIAN AARD-VARK. (From Sclater, *Proc. Zool. Soc.*)

In the way of belting, leather is not going to have everything its way as formerly. The substitution of camel's hair, cotton, paint and chemicals for leather in machinery belting is said to be meeting with some success in this country. It was first invented in England, and it is claimed for the new material that it is stronger than other belting, more durable, more efficient and as low priced.

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RECENTLY PATENTED INVENTIONS.

Engineering.

BOILER.—William Mooney, Atlantic Highlands, N. J. This invention relates especially to improvements in locomotive boilers, providing means whereby the steam taken from the dome will be very dry. Within the boiler are depending brackets supporting a sectional baffle plate beneath the dome, the plate having a detachable connection with the brackets, and the steam in the main body of the boiler is compelled to take a circuitous route which the water cannot follow, thus enabling the engine to run under full throttle or high pressure without trouble from surging or working of water in boiler.

GAUGE COCK.—James D. Mitchell, Marine City, Mich. This is a device which can be readily applied to any boiler, but is more especially designed for use on boilers in which a high steam pressure is carried. A nozzle is fixed on the valve body and adapted to be closed by a metallic plate held in a bead fitted to slide on the valve body. The pressure with which the plate is held against the nozzle can be increased or diminished by shifting a weight outward or inward on the arm of a lever fulcrumed on top of the valve body,

Railway Appliances.

CAR COUPLING.—John L. Smith, Ogden, Utah Ter. This is a simple and efficient automatic car coupling, the device permitting easy uncoupling from either the top or sides of the car. Combined with a slotted and apertured drawhead provided with a draught limb and a pivoted bail coupling link is a pivoted guard plate, a sliding lifting bar having a forwardly projecting arm, and a connection between the guard plate and lifting bar for operating the former from the latter.

CAR COUPLING.—Patrick Lee and John A. O'Farrell, Boise City, Idaho. This is an improvement on a formerly patented invention of one of these inventors, the coupling thus improved being simple and durable in construction, very effective in operation, and arranged to be readily taken apart when desired. The drawhead is formed with a hook at the top, near the front end, and a link is mounted to swing loosely in the drawhead, in which extends a transverse shaft on which are secured two arms or link lifters, each formed with two lugs engaging the sides of the link. There being two arms or link lifters for each link, and two dogs to lock the arms in place, accidental uncoupling is not likely to take place.

Mechanical.

SCREW CLAMP.—Joseph Frank and Frank H. Frankenberg, Pueblo, Col. The base of the body of this clamp is rabbeted, to slide in a guideway formed in a detachable base plate, through which projects a fastening screw, to facilitate securing the clamp in position for use. A follower or clamping plate is swiveled to the hand screw that works in the elevated front end of the clamp, and its rear portion is extended and tapered to work in a vertical guide groove in the body of the clamp, the follower being thus prevented from rotating while being adjusted by the hand screw, although free to assume different inclinations.

NUT AND BOLT LOCK.—Charles M. Stetson, Rosario, Argentine Republic. This is an improvement in nut locks in which a key and a concave washer are employed in connection with a slotted bolt. The bolt has a slot having an inclined end, and a concavo-convex washer is held on the bolt, while a toothed key passed into the slot engages with its teeth the raised edge of the washer.

Agricultural.

CULTIVATOR.—Thurston Lull, Ainsworth, Neb. This cultivator is adapted to cultivate listed corn and other crops, the knives and shovels being adjustable and so constructed as to completely cultivate all the ground between the rows, throwing up the dirt as much as necessary to each row without covering up the growing corn. The knives or shovels are adjustable independently of each other to each plow a furrow of any desired depth, or to plow a wide or narrow furrow, and by means of double clevises the knives or shovels may be set at any angle desired.

ASPARAGUS BUNDLER AND CUTTER.—John S. Van Mater, Hazlet, N. J. In a suitable frame are oppositely arranged stationary and swinging curved jaws, the swinging jaws having their lower ends formed into racks to which is geared an oscillating crank shaft moved by a lever. By means of this machine the asparagus may be quickly and nicely bundled and the butts of the stalks cut off, the jaws being actuated by a strong and easy movement, and the machine not easily getting out of repair.

HAY LOADER AND CARRIER.—Denis McCarthy, Columbus, Ohio. A framework on suitable supporting wheels has at its rear end a mechanism for raking, elevating, and discharging the hay into a storage box in which the hay is to be carried to the stack. The storage box is inclosed at its sides and top by a network of cords or cables, which may be readily removed or quickly and simultaneously tightened.

Miscellaneous.

BLANK FORM FOR KEEPING ACCOUNTS.—Theodore M. Brown, Cazenovia, Minn. This invention provides a form of account designed to effect a great saving of labor and time in keeping daily debits and credits and ascertaining and recording daily balances. A double page sheet is ruled to have ten or more special columns, arranged vertically, for individual accounts, and at the right of such columns are two more similar ones for totals, and these twelve vertical columns are sub-divided by heavy horizontal lines into parts for the business days of each month. The invention also includes several other novel features, by which the daily payments and receipts are indicated so as to be ascertainable at a glance, and the total debits and credits accrued and given each day, as well as during the whole period business has been carried on.

COIN OPERATED PHOTOGRAPH MACHINE.—Pierre V. W. Welsh, New York City. This machine has an exposure opening in the front side of the main case, beneath which is a delivery tray, while above is a coin chute, the deposit of a coin in which sets in motion a main shaft whereby all the operations of taking and finishing a picture are effected, the work being done automatically and the picture being delivered in the tray for the purchaser. The improvement is designed to provide a mechanism having simple, easy, and positive movements, to the end that the machine may work perfectly and wear well.

STORE SERVICE APPARATUS.—Abiram J. Slonecker, Farmersville, Mo. This is a simple and efficient apparatus for carrying money and merchandise from one part of a building to another. It has two parallel wires, a lever mechanism for moving them and changing their inclinations, and a car running on the upper wire has catches to engage balls on the lower wire. The car may be sent in either direction from any point on the line, or it may be stopped at any point, or brought from either end of the wire to the operator at any point on the line.

DRIER AND CARBONIZER.—Michael J. Spencer, Lawrence, Mass. This is a machine for drying and carbonizing wool or other fibrous material, there being arranged within a casing provided with a fan or blower a series of belt carriers, by which the material fed into the casing will be continuously moved until it is thoroughly dried, thus enabling the material to be dried at a comparatively low temperature, the carbonizing to be effected at a higher temperature.

SELF HOISTING FLOOD GATE.—Herbert A. Corliss, St. Helen, Oregon. This gate moves upward on a roller journaled in the sluiceway, being forced up by the water pressure, and locked in place by a ratchet mechanism. The improvement is intended for use in flumes through which logs are floated, where the water reservoir is small and it is necessary to save the water to flush the flume, to float the logs quickly through it and then shut off the water. By this means the water may be turned on and shut off instantly.

BOTTLE FILLING APPARATUS.—Amalia M. Donally, New York City. Combined with a flexible filling tube is a compressing device for compressing the tube to cut off the flow of the liquid, with mechanism for raising and lowering the compressing device, and to lower and raise the tube in and out of the bottle, a number of tubes being operated simultaneously, and each one regulated independently as desired. The improvement provides a means of filling bottles quickly and conveniently from a keg, barrel, or other receptacle.

FENCE.—James F. Ogletree, Stinson, Ga. A fence to be constructed in panels, readily disconnected for transportation, and easily set up on uneven as well as on even ground, is provided by this invention. Each panel has two end posts, with a central post also for long panels, and the construction is such that the panels have an interlocking connection, the top and bottom rails bearing on opposing end posts in opposite directions, thus forming an effective tie between the panels, while links connect the top and bottom portions of the end posts.

TRAWL ROLLER.—John B. J. D'Entremont, East Pubnico, Canada. This is a grooved roller mounted in a yoke and has its sides recessed and ratchet wheels mounted therein, there being boxes in which are gravity pawls on the inner sides of the upper ends of the members of the yoke. A brake mechanism is thus provided, whereby the rollers may be readily turned in a direction to admit of the trawl lines being drawn in readily, the mechanism automatically preventing the roller from turning outward. The mechanism may be added to any form of trawl roller at but little cost.

PHOTO PRINTING INDICATING TABLET.—John Ready, Boonville, N. Y. A simple device for indicating the number of prints taken from a negative, and showing the condition of the print when last inspected, is the object sought by this inventor. A frame is provided with two openings and a recessed back in which is inserted a celluloid or other tablet for marking on with a pencil, while there is also a slide in the recess showing through one of the openings of the frame, the slide being suitably colored, and indicating the condition at the last inspection of the print being made.

CLOTHES HANGER.—Theodore M. Garrison, Hazleton, Pa. This is a simple and inexpensive device which can be readily opened out for use and readily folded in compact space when not needed. The frame or support proper is formed of sections having sliding connections, whereby the hanger body can be readily extended or folded in, the lower end of such body being placed against a wall and its upper portion held tilted forward by means of a supporting cord passing through a sheave hanger.

BELT SUPPORT.—Louis Sanders, Brooklyn, N. Y. This is a device which may be moved freely on the belt, and has a jaw or clamp to engage a button of the trousers in connection with which the belt is used. It is made of a loop of flexible material, on the rear face of which is a stiffening plate carrying a clamp. The device prevents the belt from slipping, is inexpensive, and may be highly ornamented.

SHIRT ADJUSTER.—John H. Billings, New York City. An elastic band, whose length is adjustable by a buckle, has at its lower end a fastener adapted to engage a button of the drawers, and is connected at its upper end with the base plate of a stud or button, for buttoning on the shirt tab below the bosom. The device is very simple, and designed to hold the shirt bosom down tightly and yet permit the necessary freedom of movement to the wearer.

EGG CUTTER.—Ernest Berrini, Tacoma, Washington. This is a device for cutting off one end of an egg, by parties at a table or by a waiter, without any liability of soiling or burning the fingers. It consists of a knife having a socket to fit over the upper end of the egg, as it is held in the egg cup, a spring-controlled and latch-governed plate being then locked in open position and tripped, when the blade cuts through that portion of the shell beneath the socket of the knife.

DESIGN FOR SPOON HANDLE.—Austin F. Jackson, Taunton, Mass. This handle has at its larger end a special arrangement of the leaves, fruit, and blossoms of the orange tree, with a cluster of three oranges, the outer edges giving an irregular outline to the margin of the handle.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

ICE MAKING MACHINES. The theory of the action of the various forms of cold-producing or so-called ice machines. Translated from the French of M. Ledoux. By J. E. Denton, D. S. Jacobus & A. Riesenberger. New York: D. Van Nostrand Company. 1892. Pp. lviii, 190. Price 50 cents.

Mathematics of ice-making machines are somewhat elaborately treated of in this work, which is one that no advanced engineer in this department of work should be without. The technical nature of the book rather prohibits an effective review within the space at our command. The work, it may be said, however, is characterized by thoroughness. It embodies also numerous tables which will be acceptable to those interested in the subject treated.

PRACTICAL ELECTRIC LIGHT FITTING. By F. C. Allsop. With 224 illustrations. London: Whittaker & Co. Pp. xv, 275. Price $1.50.

The subject of wiring buildings for the production of the electric light in all its details of practical work is here given in considerable detail. Not only is the subject of buildings treated, but something of the theory of the subject and of the different systems of central station supply are also given. Very numerous illustrations, all of practical everyday type, add materially to the value of the book, which, it may be noted, is not only very fully illustrated but is excellently indexed. Street work and accumulator work are included in the topics.

THE ICE CROP. By Theron L. Hiles. New York: Orange Judd Co. 1893. Pp. 122. Price $1.

The cutting and housing of ice, the construction of ice houses, the legal and sanitary aspect of the subject, the marketing of the product, artificial ice and cold air machines, and retarding houses without ice, are suggestive topics treated by our author. In addition to these a very practical portion of the book is devoted to farm and family use of ice, and to recipes for iced food and beverages. The work is very fully illustrated and possesses an excellent table of contents, index and list of cuts—three points of merit in themselves. It will, we believe, meet a real want.

ENGINEERS' SURVEYING INSTRUMENTS, THEIR CONSTRUCTION, ADJUSTMENT, AND USE. By Ira O. Baker, C.E. Second edition. New York: John Wiley & Sons. 1892. Pp. ix, 391. Price $3.

Professor Baker in this work does something which has really been a desideratum. He treats of modern surveying instruments very fully, giving the most modern practice in their use. We note special sections devoted to the plane table and to telemeters, especially the stadia—subjects sometimes neglected by writers on surveying. Very numerous illustrations are included, and the barometer, we are glad to see, both aneroid and mercurial, receives special attention.

MAGNETISM AND ELECTRICITY. A manual for students in advanced classes. By Arthur William Poyser, M.A. London: Longmans, Green & Co. 1892. Pp. xi, 382. Price $1.50.

This book is written for the English examination—something which usually casts a shadow of limitation of scope over the works designed for such uses. The book is intended as a student's manual, and certainly does not go beyond that point. It has numerous illustrations, many of them quite familiar. Samples of South Kensington examination papers are given at the end of the work.

FIGURE SKATING, SIMPLE AND COMBINED. By Montague S. Monier-Williams, Winter Randell Pidgeon, and Arthur Dryden. With illustrations by Ronald Gray. New York: Macmillan & Co. 1892. Pp. xvi, 322. Price $2.25.

It seems impossible that so large a book could be devoted to the art of skating, but, with its diagrams and text, the book seems very fully provided with matter. It is written from an English standpoint, the writer throwing out of consideration any other skate than the permanent fixed one, the recognized favorite in England.

OLD AND NEW ASTRONOMY. By Richard A. Proctor. New York: Longmans, Green & Co. 1893. 4to. Pp. 824, 31 plates, 472 wood cuts. Price $12. Also in 12 parts at 90 cents each and 1 at 35 cents.

The publication of the "Old and New Astronomy" was announced in 1887, and the first part was published in March, 1888. At the date of Mr. Proctor's death, in September, 1888, Part VI. had been issued and Part VII. was in type. Mr. A. Cowper Ranyard was selected to finish the work. The parts which we have received are beautifully illustrated and the presswork is of the best. The great reputation of the author is sufficient guarantee for the text. We hope to be able to review the entire work at a later time.

SOUND AND MUSIC. By Rev. J. A. Zahm, C.S.C., Professor of Physics in the University of Notre Dame. Chicago: A. C. McClurg & Company. Pp. 452. 8vo. Price $3.50.

This is the title of an extraordinary book by one of our foremost workers in science. The writer, in the outset, makes acknowledgment to two eminent workers in the same line, Professor A. M. Mayer and Dr. Koenig. The volume is one which on a cursory glance appears like a popular work on the subject, but a more intimate acquaintance with its contents reveals the fact that it is a thoroughly scientific treatise, one which will give to the student a practical and theoretical knowledge of the subject. It is a book which will be of great value to the physicist, as it embraces all the modern ideas of sound and music, and includes descriptions of modern apparatus for demonstrating the principles involved. It is beautifully printed in clear type on fine paper of good weight, and is profusely illustrated. The book is tastefully bound, and is withal one of the most attractive scientific books that has come to our notice. Now that students of music are beginning to find it to their advantage to familiarize themselves with the principles upon which their art is based, it is not too much to say that in no single volume can they find the same amount of valuable information as is to be found in Professor Zahm's new book.

SINAI. By the Rev. Professor Sayce. London: Society for Promoting Christian Knowledge. New York: E. & J. B. Young & Co. 1892. Pp. 224. Price $1.

This little book is one of the series entitled "Ancient History from the Monuments." The history of the biblical region is very fully treated here, considering the limited size of the work, and the little book will be found, from its systematic arrangement, a most excellent and valuable contribution to biblical history.

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FEBRUARY, 1893, NUMBER.—(No. 88.)

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1. Elegant plate in colors, showing a very picturesque dwelling at St. David's, Pa. Floor plans and perspective elevations. An admirable design. Mr. N. Trumbauer, architect, Philadelphia, Pa.
2. Plate in colors showing a residence at Bridgeport, Conn. Two perspective views, one interior view and floor plans. Messrs. Longstaff & Hurd, architects, Bridgeport, Conn. An excellent design.
3. A model dwelling at Holyoke, Mass., erected at a cost of $6,000 complete. Perspective views and floor plans. H. W. Coolidge, architect, Holyoke. A pleasing design.
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8. An attractive design for a suburban dwelling at Holyoke, Mass. Perspective elevation and floor plans. Messrs. Gardner, Pyne & Gardner, architects, Springfield, Mass.
9. A row of model dwelling houses on West Sixty-eighth Street, New York City. An exquisite design. Floor plans and perspective.
10. A cottage at St. David's, Pa., recently erected at a cost of $5,100 complete. Floor plans and perspective elevation. Messrs. F. L. & W. L. Price, architects, Philadelphia.
11. Views of the extensive red sandstone quarries at Potsdam, N. Y., together with views of various public and private residences built of Potsdam red sandstone.
12. Perspective and floor plans for an architect's residence at Buffalo, N. Y.
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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(4661) J. Q. A. asks: 1. What truth is there in the theory that water impregnated with filth from drainage becomes pure or usable by passage over successive falls, or by being thrown to a height into the atmosphere? A. There is a good deal in the theory, not so much, however, but that every effort should be made to start a water system with pure water. Aeration cannot be relied on to destroy all injurious matter. It is known to do some good. 2. Is the Thames water at London made use of after simply throwing to a height of 50 feet? A. We do not know of any such use of the Thames water at London proper. Much of the London water comes from the New River. 3. Do any American cities use impure water after such treatment? A. Aeration is used in this country, and river water from below cities is often used, but how much of the improvement is due to dilution and how much to aeration is as yet unsettled.

(4662) A. B. asks: 1. Is there any simple method which can be relied upon to precipitate the lime contained in hard water and yet not injure the water for drinking purposes? We understand the lime cannot be eliminated by filtration. Is this a fact? A. Water may be hard from the presence of calcium sulphate or calcium bicarbonate. The latter can be precipitated by Clark's softening process, which consists in the addition of just enough lime water to precipitate the whole as neutral carbonate, followed by filtration or settling. Calcium sulphate cannot be removed by any practical process. For either impurity, simple filtration is useless. 2. How may branches and trunks of small trees be seasoned in the round to prevent splitting? A. Try painting the ends with metallic paint or coat with hot pitch.

(4663) V. N. asks if there is a chemical or chemicals which will prevent water from freezing, and if so, to how low a degree of temperature. A. A strong solution of calcium chloride will not freeze above —8°F. Glycerine mixed with water will lower its freezing point a number of degrees. Alcohol will do the same.

(4664) D. C. G.—Eight square feet of radiating to one square foot of heating surface in boilers is the usual practice.

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January 24, 1893,

AND EACH BEARING THAT DATE.

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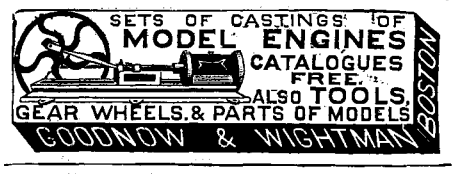

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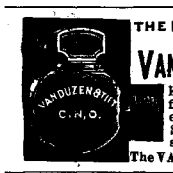

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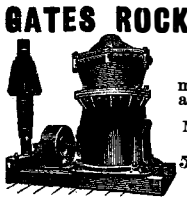

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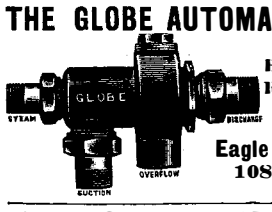

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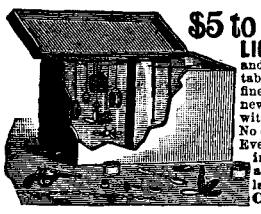

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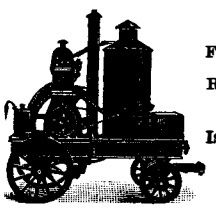

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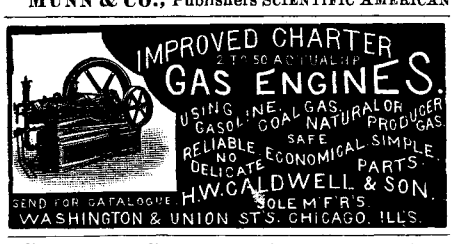

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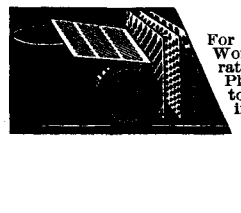

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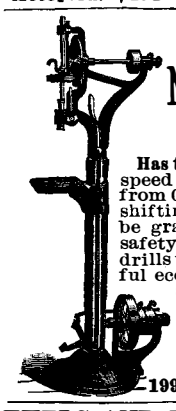

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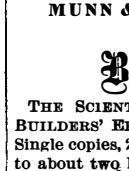

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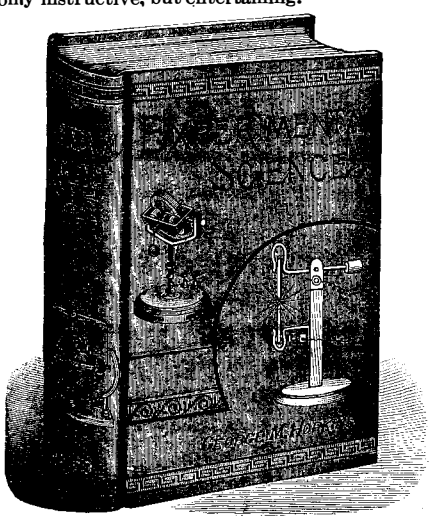

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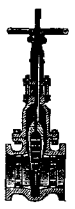

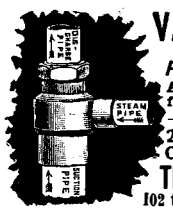

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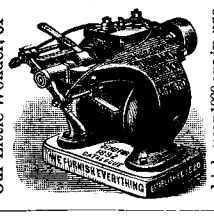

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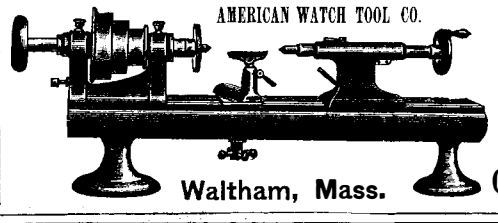

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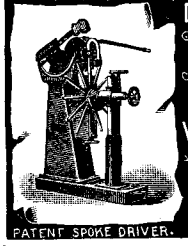

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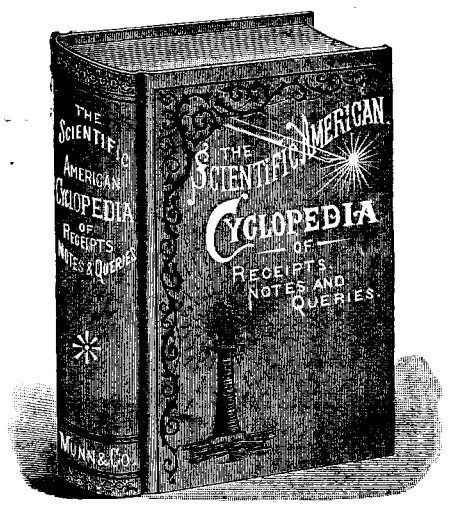

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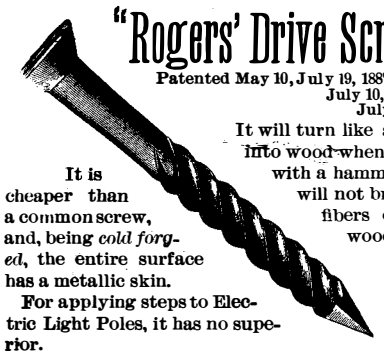

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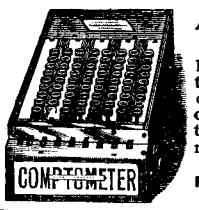

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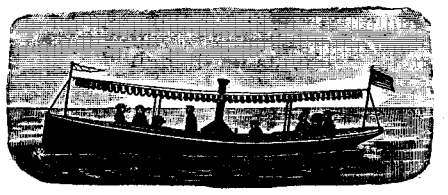

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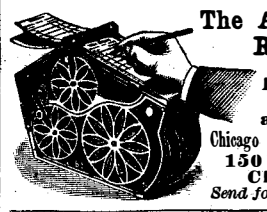

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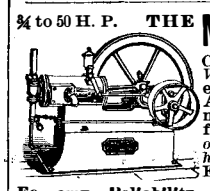

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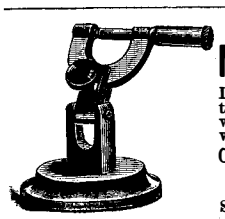

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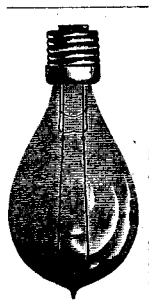

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